READING LIST
PROFESSIONAL TRAINING COURSE
ARCHEOLOGICAL SITE DISCOVERY AND SITE EVALUATION

Society for American Archaeology

Archeological Assistance Division
National Center for Preservation and Training
National Park Service

ARCHEOLOGICAL RECORD

31. Baker, C. M. 1978. The Size Effect: An Explanation Of Variability In Surface Artifact Assemblage Content. *American Antiquity* 43 (2): 288293.

32. Cook, S. F., and Heizer R.F. 1965. Studies on the Chemical Analysis of Archaeological Sites. *University of California Publications in Anthropology* 2: 1-102.

33. Drager, D., and A. Ireland. 1986. *The Seedskadee Project: Remote Sensing in Non-Site Archeology*. Albuquerque: National Park Service.

34. Dunnell, R. 1993. The Notion Site. In *Space, Time and Archaeological Landscapes.* Editor J. Rossignol, and L. Wansnider, 21-41. New York: Plenum.

35. Duvall, J. G., and W. T. Venner. 1979. A Statistical Analysis of the Lithics from the Calico Site (SBCM 1500A), California. *Journal of Field Archaeology* 6 (4): 455-462.

36. Ebert, J. I. 1992. *Distributional Archaeology.* Albuquerque: University of New Mexico Press.

37. Fehon, J. R., and S. C. Scholtz. 1978. A Conceptual Framework For the Study Of Artifact Loss. *American Antiquity* 43 (2): 271-273.

38. Foley, R. 1981. A Model of Regional Archaeological Structure. *Proceedings of the Prehistoric Society* 47: 1-17.

39. Gifford, D. P. 1980. Ethnoarchaeological to the Taphonomy of Human Sites. In *Fossils in the Making: Vertebrate Taphonomy and Paleoecology.* Editors A. K. Behrensmeyer, and A. P. Hill, 93-106. Prehistoric Archeology and Ecology Series, Editors. Karl W. Butzer, and Leslie Freeman, Chicago: University of Chicago Press.

40. Kaplan, R. W., and M. D. Coe. 1976. Pictures of the Past: Artifact Density and Computer Graphics. *Historical Archaeology* 10: 54-67.

41. Rackerby, F. 1973. A Statistical Determination of the Black Sand Occupation at the Macoupin Site Jersey C., Illinois. *American Antiquity* 38 (1): 96-101.

    uses artifact density in a practical sense, doesn't 'define' it as such.

42. Rick, J. W. 1976. Downslope Movement and Archaeological Intrasite Spatial Analysis. *American Antiquity* 41 (2): 133-144.

43. Rosen, S. 1986. A Note On Frequencies, Proportions and Diversity:A Response To Cannon. *American Antiquity* 51 (2): 409-411.

44. Scott, D. K., R. A. Fox Jr., M. A. Connor, and D. Harmon. 1989. *Archaeological Perspectives on the Battle of the Little Bighorn.* Norman: Oklahoma Press.

45. Tainter, J. A. 1979. The Mountainair Lithic Scatters: Settlement Patterns and Significance Evaluation of Low Density Surface Sites. *Journal of Field Archaeology* 6 (4): 463-469.

46. Thomas, D. H. 1973. An Empirical Test For Steward's Model Of Great Basin Settlement Patterns. *American Antiquity* 38 (2): 155-176.

47. von Frese, R. R. B. 1984. Archaeomagnetic Anomalies of Midcontinental North American Archaeological Sites. *Historical Archaeology* 18 (2): 4-19.

48. Wansnider, L., and E. Camilli. 1992. The Character of Surface Archaeological Deposits and Its Influence on Survey Accuracy. *Journal of Field Archaeology* 19: 169-88.

49. Weymouth, J. W. 1986. Archaeolgical Site Surveying Program at the University of Nebraska. *Geophysics* 51 (3): 533-537.

50. Wood, J. J. 1978. Optimal Location in Settlement Space:A Model For Describing Location Strategies. *American Antiquity* 43 (2): 258-269.

<u>CHEMICAL</u>

66. Cook, S. F., and Heizer R.F. 1965. Studies on the Chemical Analysis of Archaeological Sites. *University of California Publications in Anthropology* 2: 1-102.

67. Eidt, R. C., Editor. 1984. Advances In Abandoned Settlement Analysis: Application to Prehistoric Anthrosols in Colombia, South America. Milwaukee: University of Wisconsin.

68. Eidt, R. C. 1977. Detection and Examination of Anthrosols by Phosphate Analysis. *Science* 297: 1327-1333.

69. Eidt, R. C. 1973. A Rapid Chemical Field Test for Archeological Site Surveying. *American Antiquity* 38: 206-210.

70. Gordon, B. C. 1978. Chemical and Pedological Delimiting of Deeply Stratified Archaeological Sites in Frozen Ground. *Journal of Field Archaeology 5 (3):* 331-338.

71. Hassen, F. A. 1981. Rapid Quantitative Determination of Phosphate in Archaeological Sediments. *Journal of Field Archaeology* 8: 384-387.

72. Heidenreich, C. E., and V. A. Konrad. 1973. Soil Analysis at the Robitaille Site, Part II: A Method Useful in Determining the Location of Longhouse Patterns. *Ontario Archaeology* 20: 33-62.

73. Heidenreich, C. E., and S. Navratil. 1973. Soil Analysis at the Robitaille Site, Part I: Determining the Perimeter of the Village. *Ontario Archaeology* 20: 25-32.

74. Overstreet, D. F. 1974. A Rapid Chemical Test for Archaeological Surveying: An Application and

Evaluation. *Wisconsin Archaeologist 55:* 252-270.

75. Provan, D. M. 1971. Soil Phosphate Analysis as a Tool in Archaeology. *Norwegian Archaeological Review* 4 (1): 37-50.

The theory underlying the use of soil phosphate analysis in archaeology is discussed. After describing the field and laboratory methods used at Stavanger Museum, the method is illustrated by several examples. In all cases the results showed good agreement with the archaeological evidence, and generally provided useful supplementary information. The method may be used as a guide to the functions carried out in the different parts of a site and to the intensity of occupation. Although no hidden sites were found in a reconnaissance survey, the results indicate that the method has considerable scope in locating sites in areas destined for town development, etc. (From author's abstract).

76. Sjoberg, A. 1976. Phosphate Analysis of Anthropic Soils. *Journal of Field Archaeology* 3: 447-456.

77. Weymouth, J. W., and W. I. Woods. 1984. Combined Magnetic and Chemical Surveys of Forts Kaskaskia and de Chartes Number 1, Illinois. *Historical Archaeology* 18 (2): 20-37.

78. Woods, W. I. 1977. The Quantitative Analysis of Soil Phosphate. *American Antiquity* 42 (2): 248-252.

GENERAL

91. Ebert, *J. I.,* and T. R. Lyons. 1983. Archaeology, Anthropology, and Cultural Resources Management. In *Manual of Remote Sensing,* Second Edition ed. Editor in Chief R. N. Colwell, 1233-1304. Falls Church, VA: American Society of Photogrammetry.

92. Goodyear, A. C., L. M. Raab, and T. C. Klinger. 1978. The Status of Archaeological Research Design in Cultural Resource Management. *American Antiquity* 43 (2): 159-173.

93. McManamon, F. P. 1984. Discovering Sites Unseen. In *Advances in Archaeological Method and Theory, vol.7.* Editor M. B. Schiffer, 223-292. Orlando, Florida: Academic Press.

This article provides guidelines to help determine site discovery techniques, taking into account environmental restraints, project goals and budget. McManamon discusses two characteristics of site obtrusiveness. The first is the ease with which site contents are detectable. The second is the types of techniques necessary to discover a site. Site discovery techniques are dependent on the frequency and spatial distribution of intrasite constituents such as artifacts, features, and anthropic soil horizons. McManamon evaluates a variety of archaeological techniques for their effectiveness in site discovery such as, subsurface probe techniques, chemical tests, magnetometry, subsurface radar and remote sensing. He found shovel tests to be the most effective overall means for site discovery, although this is dependent on the abundance and distribution of artifacts, and the placement of the shovel tests. Given the constraints archaeologists usually face in site discovery, McManamon suggests examining a portion of a study area and using the sample data to estimate characteristics of the entire area. Study areas can be stratified to use a combination of probablity and judgement sampling methods.

94. Plog, S., F. Plog, and W. Wait. 1978. Decision Making in Modern Survey. In *Advances in Archaeological Method and Theory, vol. 1.* Editor M. B. Schiffer, 384-420. New York: Academic Press.

Plog et.al. outline the steps integral to the design of a an archaeological survey. They suggest that the probability for finding a site depends on the ratio between site area and the area of the sampling unit. The

first step is to define the survey boundaries. These are either natural, arbitrary, or cultural. The next step is to establish guidelines to define and determine what constitutes a site. Typically, artifact density is a factor in determining this criteria. The third step is survey intensity, which is the proportion of sampled land to 'unseen' or not sampled area. Plog et.al. found transects to be the most effective sampling units because they cover the most spatial area. Using archaeological sites in the Southwestern United States as their primary examples, Plog et.al. argue that smaller units are more efficient than larger sample units since only a part of a site needs to be located in order to establish its presence. Since larger sites are easier to find, Plog et.al. suggest there is a bias in site discovery techniques towards finding large sites. Plog et.al. determined that there is a linear relationship between survey intensity and site density. To test this hypothesis they examined the correlation between person-days per square mile and site density; the more sites that are found the more time the crew will spend on recording. The conclusions drawn in this article assume perfect visibility due to the nature of the Southwest terrain. Unit size and shape, surface collections, and time and labor costs are also considered in this article.

95. Schiffer, M. B., A. P. Sullivan, and T. C. Klinger. 1978. The Design of Archaeological Survey. *World Archaeology* 10 (1): 1-29.

Schiffer et.al. outline the procedures and issues involved with archaeological survey including the regional archaeological record and parameters, discovery probability, and survey design. Abundance is the prevalence of an artifact type and clustering refers to the way these materials are spatially aggregated. Probability sampling methods can be used effectively when visibility and accessibility are known, and estimates on abundance, clustering and obtrusiveness are available. Schiffer et. al. compare the benefits and draw backs involved with sampling unit size, number and shape. Intensity, the amount of effort devoted to inspecting surveyed areas, has the most profound effect on site discovery probablity. Schiffer et.al. outline three stages useful for survey design, beginning with Stage I, background studies; Stage 2, reconnaissance and Stage 3, intensive survey.

MANUAL TECHNIQUES

127. Alexander, D. 1983. The Limitations of Traditional Surveying Techniques in a Forested Environment. *Journal of Field Archaeology* 10 (2): 177-192.

128. Booth, B. K. W. 1983. Recording Soil Colors in the Field. *Journal of Field Archeology* 10 (1): 118-120.

129. Chartkoff, J. L. January 1978. Transect Interval Sampling in Forests. *American Antiquity* 43: 46-53.

Sampling design in excavation calls for previous estimates of site dimensions, artifact variability, and density. Sites covered by forest cannot be surface collected to gain such data. Transect interval sampling provides the data at an early stage of research, and at low cost. Chartkoff suggests the collection and processing of standard-volume soil samples. These would be taken at regular intervals from a series of transects extending outward from the known area of the site. The screening of these soil samples provides a measure of artifact density across space, and empirical density values can be plotted to create an artifact density contour interval display. An adopted value of artifact density can be used to define site limits for sampling purposes (for example, 0.04 artifacts/liter). Use of such a measure would add to the precision and validity of sampling designs that frequently use more casual ways of estimating site dimensions. Chartkoff draws on examples from three excavations to illustrate his argument, the Root site and Clark-Stringham site in Michigan and the site of Petriolo II in central Italy.

130. Cherry, J. F., J. L. Davis, and E. Mantzourani. 1991. *Landscape Archaeology as Long-Term History*. Los Angeles: Institute of Archaeology, UCLA.

131. Fish, S. K., and S. A. Kowalewski, Editors. 1990. Archaeology of Regions: A Case for Full

Coverage Survey. Washington D.C.: Smithsonian Institution Press.

132. Fry, R. E. 1972. Manually Operated Post-hole Diggers as Sampling Instruments. *American Antiquity* 37: 259-60.

133. Gatus, T. W. 1980. A Review and Comments on Surface and Subsurface Survey Methodologies Operationalized in Kentucky. *Southeasten Archeological Conference Bulletin* 28: 141-145.

134. Hoffecker, J. F. 1988. Applied Geomorphology and Archaeological Survey Strategy for Sites of Pleistocene Age: An Example from Central Alaska. *Journal of Archaeological Science* 15 (6): 683-714.

135. Kamau, C. K. 1977. Mapping of an Archaeological Site at Olduvai Gorge, Tanzania. *Journal of Field Archaeology* 4 (4): 415-422.

136. Keller, J. 1982. Lithic Scatters and Longleaf Pine: Limited Activity Areas in Pyrogenic Environments. *Southeastern Archaeology* 1: 40-51.

137. Killion, T. W., J. A. Sabloff, G. Tourtellot, and N. P. Dunning. 1989. Intensive Surface Collection of Residential Clusters at Terminal Classic Sayil, Yucatan, Mexico. *Journal of Field Archaeology* 16 (3): 273-295.

138. Kintigh, K. W. 1988. The Effectiveness of Subsurface Testing: A Simulation Approach. *American Antiquity* 53 (4): 686-707.

139. Krakker, J. J., M. J. Shott, and P. D. Welch. 1983. Design and Evaluation of Shovel-Test Sampling in Regional Archaeological Survey. *Journal of Field Archaeology* 10 (4): 469-480.

140. Lightfoot, K. G. 1989. A Defense of Shovel-Test Sampling: A Reply to Shott. *American Antiquity* 54 (2): 413-416.

This is the third article in a trilogy of debates in American Antiquity on the effectiveness of shovel-testing. In this article, Lightfoot responds to Shott, and agrees that alternative survey methods should be developed for surveying wooded environments. Unlike Shott, Lightfoot argues that shovel-test sampling is an effective discovery technique when the probability is high that material remains are buried less than 50 cm below the surface. Lightfoot addresses the issue of site definition by suggesting that discovery probability can be generated to estimate artifact population parameters across a study area. Lightfoot also recognizes the lack of a standardized form for defining sites, making cross comparisons of site densities difficult. Lightfoot also sites the shortcomings of surface collection as it only samples from a two dimensional plane, where as most artifacts are located three dimensionally. Lightfoot's major concern with the comments by Shott are the implications for cultural resource management. Given the cost and labor investment in subsurface testing some agencies and developers may try to use less intensive means to survey. Shott, in his 1989 American Antiquity article, suggests two alternative methods to shovel-test sampling which Lightfoot addresses. The first alternative is the surface survey of clear-cut forests, which Lightfoot dismisses as unrealistic since resources would need to be visible on the grdund surface. Furthermore, many government agencies and developers are skeptical of clear-cutting forests. Shott's second recommendation was to monitor construction activities. Lightfoot contests this, suggesting that it does not provide adequate planning measures, nor does it provide any basis for estimating the population parameters. Lightfoot uses a survey on Brookhaven Township to illustrate the benefits of shovel-test sampling.

141. Lightfoot, K. G. 1986. Regional Surveys in the Eastern United States: The Strengths and Weaknesses of Implementing Subsurface Testing Programs. *American Antiquity* 51 (3): 484-504.

142. Lovis, W. A. Jr. July 1976. Quarter Sections and Forests: An Example of Probability Sampling in the Northeastern Woodlands. *American Antiquity* 41: 364-372.

Problems involved in the application of probability sampling strategies to woodland environments are discussed and illustrated by example. Some directions for the development of specialized field tactics in woodland environments, including the reduction of transect intervals, the use of test-pitting, and the generation of explicit means for survey alteration, are suggested. Lovis tested several hypotheses during the 1974 field season at the Traverse Corridor, in northern Michigan. He found there is not a relationship between the presence and absence of ceramics at a site and the environmental zone in which it occurs. There was a relationship, however, between site location and its proximity to water.Lovis concluded that 1x1 foot test units worked better than using core tools for the discovery of low density sites in areas of low surface visibility. Smaller transect intervals, for example 25 yard intervals, are more reliable than larger intervals, and smaller test units (1x1 foot) are the most efficient. Lovis also argued that in woodland environments, efficiency can be increased by using cluster sampling because less time is used traveling from unit to unit.

143. Lynch, B. M. 1981. More on Shovel Probes. *Current Anthropology* 22: 438.

144. Lynch, B. M. 1980. Site Artifact Density and the Effectiveness of Shovel Probes. *Current Anthropology* 21: 516-517.

145. Mueller, M. 1994. Archaeological Survey in the Arenal Basin. In *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica.* Editors P. D. Sheets, and B. R. Mckee, 48-72. Austin, Texas: University of Texas Press.

146. Nance, J. D., and B. F. Ball. 1986. No Surprises? The Reliability and Validity of Test Pit Sampling. *American Antiquity* 51 (3): 457-484.

147. Nance, J. D., and B. F. Ball. 1989. A Shot In The Dark: Shott's Comments On Nance And Ball. *American Antiquity* 54 (2): 405-412.

This article is the second in a trilogy of commentaries in American Antiquity (1989) that examine the effectiveness of shovel-test sampling. Nance and Ball in response to a commentary by Shott (1989) reassert that among subsurface probes, shovel-test sampling is the most effective for site discovery. Nance and Ball recognize that shovel-test sampling does have its limitations, but propose that an understanding of these shortcomings can aid in the development of new techniques. They refute Shott's suggestion that the intersection probabilities that Nance and Ball used were 'absurdly high' (Nance and Ball:407 1989). They clarify their use of controlled samples and assert that their goal was to measure the effects of artifact density and aggregation on productivity probablity. In this article, Nance and Ball graph the error that arises by assuming random (Poisson) artifact distributions when they are clustered spatially. They assert that to assume random artifact distributions when these distributions are actually spatially clustered results in error. Nance and Ball agree with Shott that aggregation is secondary in importance to density in determining detection probabilities, however, it is still a factor to be considered. Nance and Ball reassert that the effects of artifact aggregation are much more pronounced for low density sites than for those with high artifact density. Nance and Ball also propose that shovel-test sampling is less effective for low density sites and the spatial clustering of artifacts is not uniform over the density gradient. They advocate the use of small portable (approximately 40x60 cm) screens. They agree that although screening adds to the cost of test pit sampling, significant and valuable data is lost when screening is not done.

148. Nicholson, B. 1983. A Comparative Evaluation of Four Sampling Techniques and of Variability of Microdebitage as a Cultural Indicator in Regional Surveys. *Plains Anthropologist* 28: 273-281.

149. Odell, G. H. 1992. Bewitched by Mechanical Site-Testing Devices. *American Antiquity 57 (4):* 692-

703.

150. Odell, G. H., and Cowan Frank. 1987. Estimating Tillage Effects on Artifact Distributions. *American Antiquity* 52 (3): 456-484.

151. Percy, G. 1976. Use of a Mechanical Earth Auger as a Substitute for Exploratory Excavation at the Torreya Site (8Li/8), Liberty County, Florida. *Florida Archaeologist* 29: 24-32.

152. Price, J. C., R. Hunter, and E. V. McMichael. 1964. Core Drilling in an Archaeological Site. *American Antiquity* 30: 219-211.

153. Reed, N. A., J. W. Bennett, and J. W. Porter. 1968. Solid Core Drillings of Monk's Mound: Techniques and Findings. *American Antiquity* 33: 137-148.

154. Schulderein, J. 1991. Coring and the Identity of Cultural Resource Environments: A Comment on Stein. *American Antiquity* 56 (1): 131-137.

155. Shott, M. 1992. Commerce or Service: Models of Practice in archaeology. In *Quandaries and Quests: Visions of Archaeology's Future.* Editor L. Wansnider, 9-24. Carbondale: Southern Illinois University.

156. Shott, M. 1985. Shovel-Test Sampling as a Site Discovery Technique: a Case Study from Michigan. *Journal of Field Archaeology* 12 (4): 457-468.

157. Shott, M. J. 1989. Shovel-Test Sampling In Archaeological Survey: Comments on Nance and Ball, and Lightfoot. *American Antiquity* 54 (2): 396-404.

This commentary by Shott questions the effectiveness of shovel-test sampling as a survey method for site discovery. Using two articles from American Antiquity by Nance and Ball(1986) and Lightfoot(1986) as the basis for his argument, Shott suggests that shovel test sampling is not effective for site discovery because a shovel test must first intersect the boundaries of a site. Furthermore, he suggests that not all areas within a sites' boundaries contain artifacts. Shott also contests the validity of the site concept, suggesting that regional distribution of sites, rather than discrete sites more accurately model the archaeological record. He criticizes Nance and Ball (1986) for assuming high intersection probabilities in sampling the boundaries of known sites. Shott suggests that this skewed value exaggerates the effectiveness of shovel test sampling. Shott acknowledges that data on average site size is limited, but that the average intersection rate suggested by Nance and Ball (1986) is too high for discovering smaller sites which are more frequent in North America. Shott argues that sites would have to be very large (80x100m) in order to be discovered by a 30 unit intersection rate. He emphasizes that the significance of artifact density is far greater than that of artifact distribution particularly in North American sites. In contrast to Nance and Ball(1986), Shott also argues that screening is inefficient because it is more labor intensive, particularly in vegetated areas. Shott refutes the use of square rather than offset grids, in Lightfoot's 1986 article in American Antiquity. Shott criticizes Lightfoot for dividing the artifacts found by the area in which the units were distributed. Rather, he contends, the artifacts should have been divided by the area occupied by sample units. Shott implies that by subdividing larger archaeological sites into smaller sites, Lightfoot inflates the average site density. The last point that Lightfoot makes which is addressed by Shott in this article is the duality of shovel-testing in ground coverage by crews moving from site to site. Although Shott praises Lightfoot's thorough examination of shovel test methods, he contests the use of shovel-test methods for site discovery because they are labor intensive, destructive and yield inaccurate data.

158. South, S., and R. Widmer. 1977. A Subsurface Sampling Strategy for Archaeological Reconnaissance. In *Research Strategies in Historical Archaeology.* Editor S. South, 119-150. New

York: Academic Press.

159. Spurling, B. E. 1980. Site Discovery and Assessment Techniques for Mixed Cover Regimes. *Saskatchewan Archaeology* 1: 25-56.

160. Stein, J. K. 1986. Coring Archaeological Sites. *American Antiquity* 51 (3): 505-527.

161. Stein, J. K. 1991. Coring in CRM and Archaeology: A Reminder. *American Antiquity* 56 (1): 138-142.

162. Stone, G. D. 1981. On Artifact Density and Shovel Probes. *Current Anthropology* 22: 182-183.

163. Wansnider, L., and E. Camilli. 1992. The Character of Surface Archaeological Deposits and Its Influence on Survey Accuracy. *Journal of Field Archaeology* 19: 169-88.

NEAR SURFACE

186. Abbott, J. T., and C. D. Frederick. 1990. Proton Magnetometer Investigations of Burned Rock Middens In West-Central Texas: Clues to Formation Processes. *Journal of Archaeological Science* 17 (5): 535-545.

187. Arnold, J. B. III. 1987. Marine Magnetometer Survey of Archaeolgical Materials near Galveston, Texas. *Historical Archaeology* 21 (1): 18-47.

188. Arnold, J. B. III, and Clausen Carl J. 1975. A Magnetometer Survey With Electronic Positioning Control and Calculator-Plotter System. *Historical Archaeology 7:* 26-40.

189. Batey, R. A. 1987. Subsurface Interface Radar at Sepphoris, Israel 1985. *Journal of Field Archaeology* 14 (1): 1-8.

190. Bevan, B. W. 1983. Electromagnetics for Mapping Buried Earth Features. *Journal of Field Archaeology* 10 (1): 46-54.

191. Bevan, B. W., D. G. Orr, and Blades Brooke S. 1984. The Discovery of the Taylor House at the Petersburg National Battlefield. *Historical Archaeology* 18 (2): 64-74.

192. Blakeslee, D. J. 1979. Mapping with an Electronic Calculator. *Journal of Field Archaeology* 6 (3): 321-328.

193. Carr, C. 1982. *Handbook on Soil Resistivity Surveying: Interpretation of Data from Earthen Archaeological Sites.* Evanston, Illinois: Center for American Archeology Press.

194. Carr, C. 1977. A New Role and Analytical Design for the Use of Resistivity Surveying in Archaeology. *Midcontinental Journal of Archaeology* 2: 161-193.

195. Clark, A. 1975. Archaeological Prospecting: A Progress Report. *Journal of Archaeological Science* 2 (4): 297-314.

196. Clark, A. 1970. Resistivity Surveying. In *Science in Archaeology.* editors D. Brothwell, and E. S. Higgs, 695-707. New York: Praeger.

197. Clark, A. 1990. *Seeing Beneath the Soil*. London: B.T. Batsford Ltd.

198. Dalan, R. A. 1991. Defining Archaeological Features with Electromagnetic Surveys at the Cahokia State Historic Site. *Geophysics* 56 (8): 1280-1287.

199. Dalan, R. A. 1989. Electromagnetic Reconnaissance of the Central Palisade at Cahokia Mounds State Historic Site. *The Wisconsin Archeologist* 70 (3): 309-332.

200. Darwin, R. L., C. R. Ferring, and B. B. Ellwood. 1990. Geoelectrical Stratigraphy and Subsurface Evaluation of Quaternary Stream Sediments at the Cooper Basin NE Texas. *Geoarchaeology: An International Journal 5 (1):* 53-79.

201. Edgerton, H. E. 1976. Underwater Archaeological Search with Sonar. *Historical Archaeology* 10: 46-53.

202. Ellwood, B. B. 1990. Electrical Resistivity Surveys in Two Historical Cemeteries in Northeast Texas: A Method for Delineating Unidentified Burial Shafts. *Historical Archaeology* 24 (3): 91-98.

203. Fischer, P. M. 1980. Geophysical Prospecting at Hala Sultan Tekke, Cyprus. *Journal of Field Archaeology 7 (4):* 479-484.

204. Garrison, E. G. 1992. Recent Advances in Close Range Photogrammetry for Underwater Historical Archaeology. *Historical Archaeology* 26 (4): 97-104.

205. Garrison, E. G., *J*. G. Baker, and D. H. Thomas. 1985. Magnetic Prospection and the Discovery of Mission Santa Catalina de Guale, Georgia. *Journal of Field Archaeology* 12 (3): 299-314.

206. Gramly, R. M. 1970. Use of Magnetic Balance to Detect Pits and Postmolds. *American Antiquity* 35: 217-220.

207. Griffiths, D. H., and R. D. Barker. 1994. Electrical Imaging in Archaeology. *Journal of Archaeological Science* 21: 153-158.

Electrical resistivity has been used to produce maps of subsurface features, and more recently, to determine the depth and geometry in vertical sections of earth. The authors identify two problems with using this technique; its high cost, and the lack of a computer data-processing program to convert field measurements into a meaningful image. Using Salmonsbury Fort and Rocester in Gloucestershire and Derbyshire, England, respectively, the authors illustrate the use of a system which controls the switching unit and the resistance meter, and stores the measurements in the memory for later processing. This method will greatly reduce measurement time, however, more sophisticated processing is required for superior image quality. The sharpest images are produced by a completely automatic computer inversion process developed by Barker (1992). The technique is illustrated with an image of true resistivity measured across a burnt mound in Birmingham.

208. Haigh, J. G. B., and M. A. Kelly. 1987. Contouring Techniques for Archaeological Distributions. *Journal of Archaeological Science* 14 (3): 231-241.

209. Heimmer, D. H. 1992. *Near-Surface, High Resolution Geophysical Methods for Cultural Resource Management and Archaeolgical Investigations.* Golden, Colorado: Geo-Recovery Systems, Inc. Purchase order No.PX-1242-1-1373.

210. Hinze, W. J. 1990. The Role of Gravity and Magnetic Methods in Engineering and Environmental

Studies. In *Geotechnical and Environmental Geophysics, vol. 1*. Editor S. H. Ward, 75-126. Tulsa, Oklahoma: Society of Exploration Geophysics.

211. Johnston, R. B. 1964. Proton Magnetometry and its Application to Archaeology: An Evaluation at Angel Site. *Indiana Historical Society, Prehistory Research Series* 4 (2): 45-140.

212. King, J. A., Bevan Bruce W., and R. J. Hurry. 1993. The Reliability of Geophysical Surveys at Historic Period Cemeteries: An Example from the Plains Cemetery, Mechanicsville, Maryland. *Historical Archaeology* 27 (3): 4-16.

213. Klasner, J. C., and Calengas. 1981. Electrical Resistivity and Soils Study at Orendorf Archaeolgical Site, Illinois: A Case Study. *Journal of Field Archaeology* 8: 167-174.

214. Limp, W. F. 1993. Multispectral Digital Imagery. In *The Development of Southeastern Archaeology.* Editor J. K. Johnson, 184-206. Tuscaloosa: The University of Alabama Press.

215. Martin, W. A., J. E. Bruseth, and R. J. Huggins. 1991. Assessing Feature Function and Spatial Patterning of Artifacts with Geophysical Remote-Sensing Data. *American Antiquity* 56 (4): 701-720.

216. Mason, R. J. 1984. An Unorthodox Magnetic Survey of a Large Forested Historic Site. *Historical Archaeology* 18 (2): 54-63.

217. Nelson, S. M., M. Plooster, and D. L. Ford. 1987. An Interactive Computer Graphic Technique for Identifying Occupation Surfaces in Deep Archaeological Sites. *Journal of Field Archaeology* 14 (3): 353-358.

218. Parrington, M. 1979. Geophysical and Aerial Prospecting Techniques at Valley Forge National Historical Park, Pennsylvania. *Journal of Field Archaeology* 6 (2): 193-202.

219. Scollar, I. 1969. Some Techniques for the Evaluation of Archaeological Magnetometer Surveys. *World Archaeology* 1: 77-89.

220. Scollar, I., A. Tabbagh, A. Hesse, and Herzog I. 1990. *Archaeological Prospecting and Remote Sensing.* Cambridge: University Press.

221. Scott, D. K., and R. A. Fox Jr. 1987. *Archaeological Insights into the Custer Battle: An Assessment of the 1984 Field Season.* Norman: University of Oklahoma Press.

222. Scott, D. D., and P. R. Nickens. 1991. Nonintrusive Site Evaluation and Stabilization Technologies for Archaeological Resources. *The Public Historian* 13 (3): 85-96.

223. Steponaitis, V. P., and J. Brain. 1976. A Portable Differential Proton Magnetometer. *Journal of Field Archaeology* 3 (4): 455-463.

224. Tabbagh, A. 1986. Applications and Advantages of the Slingram Electromagnetic Method for Archaeological Prospecting. *Geophysics* 51: 576-584.

225. Tabbagh, A. 1984. On the Comparison Between Magnetic and Electromagnetic Prospection Methods for Magnetic Features Detection. *Archaeometry* 26 (2): 171-182.

226. Vickers, R. S., and Dolphin L.T. 1976. Archeological Investigations at Chaco Canyon Using a

Subsurface Radar. In *Remote Sensing Experiments in Cultural Resource Studies.* Assembler T. R. Lyons, 81-101. Reports of the Chaco Center, No. 1. Albuquerque, New Mexico: The Chaco Center, National Park Service and The University ofNew Mexico.

227. von Frese, R. R. B. 1984. Archaeomaghetic Anomalies of Midcontinental North American Archaeological Sites. *Historical Archaeology* 18 (2): 4-19.

228. von Frese, R. R. B., and V. E. Noble. 1984. Magnetometry for Archaeological Exploration of Historical Sites. *Historical Archaeology* 18 (2): 38-53.

229. Weymouth, J. W. 1986. Geophysical Methods of Archaeological Site Surveying. In *Archaeolgical Method and Theory, vol.9.* Editor M. B. Schiffer, 311-395. Orlando, Florida: Academic Press, Inc.

In this article, Weymouth provides an overview with examples of several geophysical methods that can be used for intrasite archaeological surveying. Outlined in this article are five particular geophysical methods; seismic, electromagnetic, resistivity, magnetometry, and radar. Seismic methods detect the differences in soils and rock through the reflection and refraction of sound. Electromagnetic methods detect magnetic properties of objects and soils below the surface by transmitting an alternating current, or pulse, between two coils. Weymouth argues that seismic techniques are slow, difficult to interpret and produce somewhat ambiguous results. In contrast, he suggests that resistivity surveying is very useful and fairly inexpensive for site assessment. Resistivity surveying measures the electrical resistivity or conductivity of soil near the surface. Resistivity is particularly useful in detecting intrusive structural features like foundations, walls and cellars. Magnetometry detects rocks, soils and iron objects magnetized by the field of the earth which slightly distort the local magnetic field. Weymouth discusses three types of magnetometers that are used in archaeological surveys; fluxgate gradiometer, alkali metal magnetometer, and the proton free precession magnetometer. Ground penetrating radar is the most expensive method but generates the greatest amount of information. Radar directs a pulse of electromagnetic radiation into the earth. The return time from discontinuities of electrical properties of soils provides information on the depths of features. Radar operates best when soil resistivity is high and when attenuation is low. In this article, Weymouth also provides a clear chart including cost efficiency, favorable conditions, and restrictions to employing one site discovery technique over another.

230. Weymouth, J. W., and R. K. Nickel. 1977. A Magnetometer Survey of the Knife River Indian Villages. *Plains Anthropologist* 22 (78:2): 104-118.

231. Weymouth, J. W., and W. I. Woods. 1984. Combined Magnetic and Chemical Surveys of Forts Kaskaskia and de Chartes Number 1, Illinois. *Historical Archaeology* 18 (2): 20-37.

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<u>**REMOTE SENSING**</u>

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246. Aikens, C. M., W. G. Loy, M. D. Southard, and R. C. Hanes. 1980. *Remote Sensing A Handbook for Archeologists and Cultural Resource Managers Basic Manual Supplement: Oregon.* Cultural Resources Management Division, National Park Service, U.S. Department of the Interior, Washington, D.C. For Sale by the Superintendent of Documents, U.S. Government Printing Office.

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247. Avery, T. E., and T. R. Lyons. 1981. *Remote Sensing Aerial and Terrestrial Photography for Archeologists.* Cultural Resources Management Division, National Park Service, U.S. Department of the Interior, Washington, D.C. For sale by the Superintendent of Documents, U.S.Government Printing Office, Washington D.C. 20402.

248. Baker, C., and G. J. Gumerman. 1981. *Archeological Applications of Remote Sensing in the North Central Lowlands.* Cultural Resources Management, National Park Service, U.S.Department of the Interior, Washington, D.C. For Sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

249. Brown, G. N., and J. I. Ebert. 1980. Correlations Between Cover Type and Lithology in the Teshekpuk Lake Area, Alaska: A Remote Sensing Analysis. In *Cultural Resources Remote Sensing.* Editors T. R. Lyons, and F. J. Mathien, 51-78. Washington, D.C.: Cultural Resource Management Division, National Park Service.

250. Bruder, S. J., E. G. Large, and B. L. Stark. 1975. A Test of Aerial Photography in Esturine Mangrove Swamp in Veracruz, Mexico. *American Antiquity* 40 (3): 330-337.

251. Carr, C. 1982. *Handbook on Soil Resistivity Surveying: Interpretation of Data from Earthen Archaeological Sites.* Evanston, Illinois: Center for American Archeology Press.

252. Clark, A. 1970. Resistivity Surveying. In *Science in Archaeology.* editors D. Brothwell, and E. S. Higgs, 695-707. New York: Praeger.

253. Custer, J. F., T. Eveleigh, V. Klemas, and I. Wells. 1986. Application of LANDSAT Data and Synoptic Remote Sensing to Predictive Models for Prehistoric Archaeological Sites: An Example from the Delaware Coastal Plain. *American Antiquity* 51 (3): 572-588.

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255. DeVore, S. L. 1990. Ground Penetrating Radar as a Tool in Archaeological Investigations: An Example from Fort Laramie National Historic Site. *The Wyoming Archaeologist* 33 (1-2): 23-38.

256. DeVore, S. L., W. C. Brennan, and T. M. Deignan. 1992. Geophysical Applications in Archaeology: A Case Study at the Twelve Mile House (5AH121), Arapahoe County, Colorado. *Southwestern Lore* 58 (1): 1-16.

257. Dorbrin, M. B., and C. H. Savit. 1988. *Introduction to Geophysical Prospecting,* 4th ed.New York: McGraw-Hill.

258. Drager, D., and A. Ireland. 1986. *The Seedskadee Project: Remote Sensing in Non-Site Archeology.* Albuquerque: National Park Service.

259. Ebert, J. I. 1984. Remote Sensing Applications in Archaeology. In *Advances in Archaeological Method and Theory vol. 7.* Editor M. B. Schiffer, 293-362. New York: Academic Press.

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Present and Predicting the Past: Theory, Method and Application of Archaeological Predictive Modeling. Editors W. J. Judge, and L. Sebastion, 429-492. Denver, Colorado: USDI Bureau of Land Management.

261. Ebert, J. I., Brown D.L., D. P. Hsu, and Lyons T.R. 1980. Remote Sensing in Large-Scale Cultural Resources Survey: A Case Study from the Arctic. In *Cultural Resources Remote Sensing.* Editors T. R. Lyons, and Mathien F.J., 7-54. Washington, D.C.: Cultural Resource Management Division, National Park Service.

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263. Ebert, J. I., T. R. Lyons, and D. L. Drager. 1979. Comments On 'Application of Orthophoto Mapping to Archaeological Problems'. *American Antiquity* 44 (2): 341-344.

264. Ehrenhard, E. B., and W. H. Wills. 1980. Ninety Six National Historic Site South Carolina. In *Cultural Resources Remote Sensing.* Editors T. R. Lyons, and F. J. Mathien, 229-291. Washington, D.C.: Cultural Resources Management Division, National Park Service.

265. Ehrenhard, J. E. 1980. Cultural Resource Inventory of the Big Cypress Swamp: An Experiment in Remote Sensing. In *Cultural Resources Remote Sensing.* Editors T. R. Lyons, and F. J. Mathien, 105-117. Washington, D.C.: Cultural Resources Management Division, National Park Service.

266. Ellwood, B. B. 1990. Electrical Resistivity Surveys in Two Historical Cemeteries in Northeast Texas: A Method for Delineating Unidentified Burial Shafts. *Historical Archaeology* 24 (3): 91-98.

267. Estes, J. E., J. R. Jensen, and L. R. Tinney. 1977. The Use of Historical Photography For Mapping Archaeological Sites. *Journal of Field Archaeology* 4 (4): 441-448.

268. Evans, R., and R. J. A. Jones. 1977. Crop Marks and Soils at Two Archaeological Sites in Britain. *Journal of Archaeological Science* 4: 63-76.

269. Fagan, B. 1959. Cropmarks in Antiquity. *Antiquity* 33: 297-81.

270. Fowler, M. L. 1977. Aerial Archeology at the Cahokia. In *Aerial Remote Sensing Techniques in Archaeology.* Editor T. R. Lyons, and R. K. Hitchcock, 65-80. Reports of the Chaco Center, 2. Albuquerque, New Mexico: The Chaco Center, National Park Service, and The University of New Mexico.

271. Gould, R. A. 1987. Archaeological Survey by Air: A Case from the Australian Desert. *Journal of Field Archaeology* 14 (4): 431-443.

272. Harp, E. Jr. 1977. Aerial Photography for the Arctic Archeologist. In *Aerial Remote Sensing Techniques in Archeology.* Editors T. R. Lyons, and R. K. Hitchcock, 51-64. Reports of the Chaco Center, 2. Albuquerque, New Mexico: The Chaco Center, National Park Service, and The University of New Mexico.

273. Harp, E. Jr. 1974. Threshold Indicators of Culture in Air Photo Archeology: A Case Study in the Arctic. In *Aerial Photography in Anthropological Field Research.* Editor E. Vogt, 14-27. Cambridge, Massachusetts: Harvard University Press.

274. Hassen, F. A. 1981. Rapid Quantitative Determination of Phosphate in Archaeological Sediments. *Journal of Field Archaeology* 8: 384-387.

275. Heimmer, D. H. 1992. *Near-Surface, High Resolution Geophysical Methods for Cultural Resource Management and Archaeolgical Investigations.* Golden, Colorado: Geo-Recovery Systems, Inc. Purchase order No.PX-1242-1-1373.

276. Kenyon, J. L. 1977. Ground Penetrating Radar and Its Application to a Historical Archaeological Site. *Historical Archaeology* 11: 48-55.

277. King, J. A., Bevan Bruce W., and R. J. Hurry. 1993. The Reliability of Geophysical Surveys at Historic Period Cemeteries: An Example from the Plains Cemetery, Mechanicsville, Maryland. *Historical Archaeology* 27 (3): 4-16.

278. Klasner, J. C., and Calengas. 1981. Electrical Resistivity and Soils Study at Orendorf Archaeolgical Site, Illinois: A Case Study. *Journal of Field Archaeology* 8: 167-174.

279. Kruckman, L. 1987. The Role of Remote Sensing in Ethnohistorical Research. *Journal of Field Archaeology* 14 (3): 343-351.

280. Lyons, T. R., Assembler. 1976. In *Remote Sensing Experiments in Cultural Resource Studies: Nondestructive Methods of Archeological Exploration, Survey and Analysis.Reports* of the Chaco Center, No. 1. Albuquerque, New Mexico: The Chaco Center, The National Park Service, and the University of New Mexico, Albuquerque.

281. Lyons, T. R., and T. E. Avery. 1977. *Remote Sensing: A Handbook for Archeologists and Cultural Resource Managers.* Washington, D.C.: Cultural Resource Management Division, National Park Service, U.S. Department of the Interior.

The purpose of this handbook is to provide archaeologists with the basic principles of remote sensing. It presents some explanation of the application of imaged and digital remote sensing data which are more time efficient and less costly than traditional field methods. The book is divided into several sections reviewing issues, methods and techniques in aerial photography, photographic and mosaic mapping, imaging and nonimaging sensors, interpretation of remote sensing data and interpretation of human alteration of landscapes and vegetation, and lastly, photogrammetric mapping and use in cultural resource management. This article includes technical specifications on materials, equipment and procedure, such as, a chart listing the days suitable for aerial photography by state and month, film types (black and white, infrared etc.), and types of stereoscopes. Examples of maps and aerial photographs from Chaco Canyon, Yosemite National Park, and Pima and Coconino Counties, Arizona are provided. There is also a glossary of terms related to archaeology, photography and remote sensing provided by the editors.

282. Lyons, T. R., and E. Ebert, Editors. 1978. *Remote Sensing and Non-Destructive* Archeology.Albuquerque, New Mexico: Remote Sensing Division, Southwest Cultural Resources Center, National Park Service, University of New Mexico.

283. Lyons, T. R., and R. K. Hitchcock, Editors. 1977. In *Aerial Remote Sensing Techniques in Archeology.Reports* of the Chaco Center, 2. Albuquerque, New Mexico.: The Chaco Center, National Park Service and the University of New Mexico.

284. Lyons, T. R., R. K. Hitchcock, and W. H. Wills. 1980. *Aerial Anthropological Perspectives: A Bibliography of Remote Sensing in Cultural Resource Studies.* Washington, D.C.: Cultural Resource

Management Division, National Park Service.

285. Lyons, T. R., and Mathien F.J., Editors. 1980. *Cultural Resources Remote Sensing.Washington, D.C.:* Cultural Resources Management Division, National Park Service.

This volume is one of a series of collected papers which serves to disseminated information on the results of the practical application of remote sensing techniques. Using examples from case studies in Teshekpuk Lake Area, Alaska, Chaco Canyon National Monument, New Mexico, and Big Cypress Swamp, Florida. Lyons and Mathien review the cost effectiveness, accuracy and general use of remote sensing techniques. This volume is divided into four parts. The first section on sampling and survey emphasizes methods developed to handle problems faced in large regions where mapping, surveying and projection of land use are important considerations. A sample strategy developed for the study of the National Petroleum Reserve in Alaska is examined in an article by D. Hsu. An article by Brown and Ebert on Teshehpuk Lake, on the Arctic Coastal Plain, describes sampling a limited portion of a larger area in order to assess which sampling strategy would be the most effective. The second section focuses on vegetation and environment. An article by J.Ehrenhard examines how size and dense vegetation at Big Cypress National Preserve generated special reconnaissance problems that were solved through the interpretation of high-level color infrared imagery. In contrast, the environment of the southwest deemed aerial photography necessary to discover and examine prehistoric roadways at Chaco Canyon. The third chapter, on ephemeral archaeological features, examines how remote sensing can be applied to discovery and recording processes. In a paper by Ebert and Hitchcock, discovery of the prehistoric Hohokam canals from Skylab III and Landsat imagery illustrate that despite urban alterations, past land use can be detected. This section also examines the use of remote sensing techniques in a non-arid climate with dense vegetation. Several chapters considering the impact of remote sensing on locating Greene's Encampment, Ninety Six National Historic Site in South Carolina are also included. The final section of this volume discusses photogrammetry, which is the technique for measuring photographs. Ehrenhard found this remote sensing method extremely efficient because it enabled archaeological teams to locate baselines and delineate survey areas before entering the field. Therefore teams were not spending time trying to locate landmarks and survey boundaries in the field. Klausner emphasizes the use of the bipod in recording objects as they are located on the site. Boyer examines problems in rectifying optical illusions that can occur when using the bipod. An article by Ireland discusses a mapping procedure that is not as accurate as photogrammetric maps, but does provide a quick and inexpensive method for creating maps of high quality.

286. Martin, W. A., J. E. Bruseth, and R. J. Huggins. 1991. Assessing Feature Function and Spatial Patterning of Artifacts with Geophysical Remote-Sensing Data. *American Antiquity* 56 (4): 701-720.

287. Matheny, R. T. 1962. Value of Aerial Photography in Surveying Archaeological Sites in Coastal Jungle Regions. *American Antiquity* 28: 226-230.

288. McCauley, J. F., G. G. Schaber, C. S. Breed, M. J. Grolier, M. J. Haynes, B. Issawl, C. Elacht, and R. Blom. 1982. Subsurface Valleys and Geoarcheology of the Eastern Sahara Revealed by Shuttle Radar. *Science* 218: 1004-1020.

289. Mckee, B. R., T. L. Sever, and P. D. Sheets. 1994. Prehistoric Footpaths in Costa Rica: Remote Sensing and Field Verification. In *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica.* Editors P. D. Sheets, and B. R. Mckee, 142-157. Austin, Texas: University of Texas, Austin.

290. Mckee, B. R., and T. L. Sever. 1994. Remote Sensing in the Arenal Region. In *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica.* Editors P. D. Sheets, and B. R. Mckee, 135-141. Austin, Texas: University of Texas Press.

291. McManamon, F. P. 1984. Discovering Sites Unseen. In *Advances in Archaeological Method and Theory, vol.7.* Editor M. B. Schiffer, 223-292. Orlando, Florida: Academic Press.

This article provides guidelines to help determine site discovery techniques, taking into account environmental restraints, project goals and budget. Mcmanamon discusses two characteristics of site obtrusiveness. The first is the ease with which site contents are detectable. The second is the types of techniques necessary to discover a site. Site discovery techniques are dependent on the frequency and spatial distribution of intrasite constituents such as artifacts, features, and anthropic soil horizons. McManamon evaluates a variety of archaeological techniques for their effectiveness in site discovery such as, subsurface probe techniques, chemical tests, magnetometry, subsurface radar and remote sensing. He found shovel tests to be the most effective overall means for site discovery, although this is dependent on the abundance and distribution of artifacts, and the placement of the shovel tests. Given the constraints archaeologists usually face in site discovery, McManamon suggests examining a portion of a study area and using the sample data to estimate characteristics of the entire area. Study areas can be stratified to use a combination of probablity and judgement sampling methods.

292. Morain, S. A., and T. K. Budge. 1978. *Instrumentation for Remote Sensing in Archeology.* Washington, D.C.: Cultural Resource Management Division, National Park Service.

293. Newman, R. W., and K. M. Byrd. 1980. Aerial Imagery in Locating and Managing Archaeological Resources Along the Louisiana Coast. *Louisiana Archaeology 7:* 101-108.

294. Nichols, D. L. 1988. Infrared Aerial Photography and Prehispanic Irrigation at Teotihuacan: The Tlajinga Canals. *Journal of Field Archaeology* 15 (1): 17-27.

295. Palmer, R. 1977. A Computer Method of Transcribing Information Graphically from Oblique Aerial Photographs to Maps. *Journal of Archaeological Science* 4 (3): 283-290.

296. Palmer, R. 1976. A Method of Transcribing Archaeological Sites from Oblique Aerial Photographs. *Journal of Archaeological Science* 3 (4): 391-394.

297. Parrington, M. 1979. Geophysical and Aerial Prospecting Techniques at Valley Forge National Historical Park, Pennsylvania. *Journal of Field Archaeology* 6 (2): 193-202.

298. Persons, S. 1990. Burial Detection Using Ground Penetrating Radar. Third International Conference on Ground Penetrating Radar, Lakewood, Colorado, 1990.

299. Piccolo, M. Ground Penetrating Radar Surveys for Archaeological Purposes. International Conference on Ground Penetrating Radar, Lakewood, Colorado, 1990.

300. Reeves, D. M. 1936. Aerial Photography and Archaeology. *American Antiquity* 2: 102-107.

301. Roosevelt, A. C. 1991. *Moundbuilders of the Amazon, Geophysical Archaeology of Arajo Island, Brazil.* San Diego, California: Academic Press.

302. Scollar, I., Editor. 1990. Archaeological Prospecting and Remote Sensing. Topics in Remote Sensing, Gary Hunt, and Rycroft Michael, 2. Cambridge: Cambridge University Press.

303. Scott, D. D., and P. R. Nickens. 1991. Nonintrusive Site Evaluation and Stabilization Technologies for Archaeological Resources. *The Public Historian* 13 (3): 85-96.

304. Scott, S. D., P. K. Scott, J. W. F. Smith, and J. Macleay. 1991. Reorientation of Historical Maps of Old Fort Niagara Using Computer-Assisted Cartography. *Journal of Field Archaeology* 18 (3): 319-

344.

305. Sterud, E. L., and P. P. Pratt. 1975. Archaeological Intra-Site Recording with Photography. *Journal of Field Archaeology* 2 (1/2): 151-167.

306. Strandberg, C. H., and R. Timlinson. 1969. Photoarchaeological Analysis of Potomac River Fish Traps. *American Antiquity* 34: 312-319.

307. Tabbagh, A. 1986. Applications and Advantages of the Slingram Electromagnetic Method for Archaeological Prospecting. *Geophysics* 51: 576-584.

308. Tabbagh, A. 1984. On the Comparison Between Magnetic and Electromagnetic Prospection Methods for Magnetic Features Detection. *Archaeometry* 26 (2): 171-182.

309. Tartaglia, L. *J.* 1977. Infrared Archeological Reconnaissance. In *Aerial Remote Sensing Techniques in Archeology*. Editor T. R. Lyons, and R. K. Hitchcock, 35-50. Reports of the Chaco Center, No.2. Albuquerque, New Mexico: The Chaco Center, National Park Service and The University of New Mexico.

310. Tite, M. S., and C. Mullins. 1970. Electromagnetic Prospecting on Archaeological Sites Using a Soil Conductivity Meter. *Archaeometry* 12 (1): 97-104.

311. Turpin, S. A., R. P. Watson, S. Dennett, and H. Muessig. 1979. Stereophotogrammetric Documentation of Exposed Archaeological Features. *Journal of Field Archaeology* 6 (3): 329-338.

site recording.

312. Wendorf, F., A. E. Close, and R. Schild. 1987. A Survey of the Egyptian Radar Channels: An Example of Applied Archaeology. *Journal of Field Archaeology* 14 (1): 43-64.

313. Wood, W. R., R. K. Nickel, and D. E. Griffin. 1984. Remote Sensing: The American Great Plains. Supplement No. 9. IN *Remote Sensing: A Handbook for Archaeologists and Cultural Resource Managers.* Editors Lyons T.R., and T. E. Avery,Washington, D.C.: National Park Service, U.S. Department of the Interior.

314. Wynn, J. C. 1984. The Self-Potential(SP) Method: An Inexpensive Reconnaissance and Archaeological Mapping Tool. *Journal of Field Archaeology* 11 (2): 194-205.

SAMPLING

326. Dunnell, R. C., and W. S. Dancey. 1983. The Siteless Survey: A Regional Scale Data Collection Strategy. In *Advances in Archaeological Method and Theory vo.6.* Editor M. B. Schiffer, 267-287. New York: Academic Press.

327. Gallant T.W. 1986. 'Background Noise' and Site Definition: a Contribution to Survey Methodology. *Journal of Field Archaeology* 13 (4): 403-418.

328. Kellog, D. C. 1987. Statistical Relevance and Site Locational Data. *American Antiquity* 52 (1): 143-150.

329. Kvamme, K. L. 1990. One Sample Tests In Regional Archaeolgical Analysis: New Possibilities

Through Computer Technology. *American Antiquity* 55 (2): 367-381.

330. Lovis, W. A. Jr. July 1976. Quarter Sections and Forests: An Example of Probability Sampling in the Northeastern Woodlands. *American Antiquity* 41: 364-372.

Problems involved in the application of probability sampling strategies to woodland environments are discussed and illustrated by example. Some directions for the development of specialized field tactics in woodland environments, including the reduction of transect intervals, the use of test-pitting, and the generation of explicit means for survey alteration, are suggested. Lovis tested several hypotheses during the 1974 field season at the Traverse Corridor, in northern Michigan. He found there is not a relationship between the presence and absence of ceramics at a site and the environmental zone in which it occurs. There was a relationship, however, between site location and its proximity to water. Lovis concluded that 1x1 foot test units worked better than using core tools for the discovery of low density sites in areas of low surface visibility. Smaller transect intervals, for example 25 yard intervals, are more reliable than larger intervals, and smaller test units (1x1 foot) are the most efficient. Lovis also argued that in woodland environments, efficiency can be increased by using cluster sampling because less time is used traveling from unit to unit.

331. McManamon, F. P. 1994. Discovering and Estimating the Frequencies and Distributions of Archaeological Sites in the Northeast. In *Cultural Resource Management: Archaeological Research, Preservation Planning, and Public Education in the Northeastern United States.* Editor J. E. Kerber, 99-114.

332. Nance, **J. D.** 1979. Regional Subsampling and the Statistical Inference in Forested Habitats. *American Antiquity* 44: 172-176.

333. Nance, J. D. 1983. Regional Sampling in Archaeological Survey: The Statistical Perspective. In *Advances in Archaeological Method and Theory volume* 6.Editor. M. B. Schiffer, New York: Academic Press.

This article examines the potential of statistical survey, ranging from estimating the average density of cultural remains in a region to estimating the meaningful parameter of those remains. Nance defines discovery model sampling as the confidence of finding archaeological remains within given expenditure of energy, such as labor, budget, and time. Nance notes the difference between prospecting which is to predict the location of cultural remains given statistically definable spatial trends, and statistical estimation which is to infer something about the quantitative properties of an entire area from a small sample. Nance argues the importance of discovery model sampling and the relationship between the spatial clustering of cultural remains and the organization of site survey techniques, like test-pit sampling. A ratio of cost to accuracy can be used to determine which of these models is best suited for a particular project. Nance argues that the sample standard deviation is the most important variable in discovery model sampling because existing estimates of site density are positively biased through estimations of site 'size' and site 'edge'. Also examined in this article are cluster and element sampling designs, site intensity, and test-pit subsampling. Nance concludes by identifying a need for a sampling design aimed at locating obtrusive remains combined with a subsampling procedure that would estimate less obvious remains. Test pit subsampling of quadrants and transects appear to be the most effective method of testing in dense vegetation, however, Nance challenges this assumption on the basis that the number of sites that have not been discovered is unknown.

334. Nance, J. D. 1981. Statistical Fact and Archaeological Faith: Two Models in Small-Sites Sampling. *Journal of Field Archaeology* 8: 151-65.

It is the purpose of this paper to examine some of the assumptions about the ability to recover certain classes of data through archaeological excavation. Using the Lower Cumberland Archaeological project in western Kentucky, Nance evaluates several methods involved in small site sampling. Nance cautions that information in this article is specific to single component sites, that are small, shallow and lack surface features. Element sampling is when the elements, or members of a sample, are selected independently of each other from a statistical population. Grid units are an example of element sampling. A cluster sample is when elements are selected in groups (clusters), for example cultural material. In determining which discovery method to employ, one must take into account the perceived abundance of an item class. Some variables that determine abundance are size of the excavation unit, frequency of the item class in relation to the overall cultural population,and the degree of dispersal of the item within the site matrix. The purpose of the discovery model is to know the full range of classes of items, where as the purpose of the statistical precision model is to define the parameters of the population of items in a site. Nance concludes that when using the statistical precision model, absolute sample size is more important than the proportion of the population appearing in the sample. On the other hand, in discovery model sampling, the sample fraction is critical. Nance argues that there are two means for controlling precision; the number and size of sample units.

335. Nance, J. D., and B. F. Ball. 1981. The Influence of Sampling Unit Size on Statistical Estimates in Site Sampling. In *Plowzone Archeology: Contributions to Theory and Technique.* Editors M. J. O'Brien, and D. E. Lewarch, 51-70. Publications in Anthropology, 27. Nashville, TN: Vanderbilt University.

336. O'Neil, D. H. 1993. Excavation Sample Size. *American Antiquity* 58 (3): 523-529.

337. Plog, S. 1978. Sampling in Archaeological Surveys: A Critique. *American Antiquity* 43 (2): 280-285.

338. Plog, S., and M. Hegmon. 1993. The Sample Size-Richness Relation: The Relevance of Research Questions, Sampling Strategies, and Behavioral Variation. *American Antiquity* 58 (3): 489-496.

339. Plog, S., F. Plog, and W. Wait. 1978. Decision Making in Modern Survey. In *Advances in Archaeological Method and Theory, vol. 1.* Editor M. B. Schiffer, 384-420. New York: Academic Press.

Plog et.al. outline the steps integral to the design of a an archaeological survey. They suggest that the probability for finding a site depends on the ratio between site area and the area of the sampling unit. The first step is to define the survey boundaries. These are either natural, arbitrary, or cultural. The next step is to establish guidelines to define and determine what constitutes a site. Typically, artifact density is a factor in determining this criteria. The third step is survey intensity, which is the proportion of sampled land to 'unseen' or not sampled area. Plog et.al. found transects to be the most effective sampling units because they cover the most spatial area. Using archaeological sites in the Southwestern United States as their primary examples, Plog et.al. argue that smaller units are more efficient than larger sample units since only a part of a site needs to be located in order to establish its presence. Since larger sites are easier to find, Plog et.al. suggest there is a bias in site discovery techniques towards finding large sites. Plog et.al. determined that there is a linear relationship between survey intensity and site density. To test this hypothesis they examined the correlation between person-days per square mile and site density; the more sites that are found the more time the crew will spend on recording. The conclusions drawn in this article assume perfect visibility due to the nature of the Southwest terrain. Unit size and shape, surface collections, and time and labor costs are also considered in this article.

340. Plog Stephen. 1976. Relative Efficiencies of Sampling Techniques for Archeological Surveys. In *The Early Mesoamerican Village.* Editor K. V. Flannery, 136-158. New York: Academic Press.

341. Read, D. W. 1986. Sampling Procedures for Regional Surveys: a Problem of Representativeness and Effectiveness. *Journal for Field Archaeology* 13 (4): 477-492.

342. Redman, C. L. 1973. Multistage Fieldwork and Analytical Techniques. *American Antiquity* 38 (1):

61-79.

343. Redman, C. L. 1987. Surface Collection, Sampling And Research Design: A Retrospective. *American Antiquity* 52 (2): 249-265.

344. Scheps, S. 1982. Statistical Blight. *American Antiquity* 47 (4): 836-851.

345. Shott, M. *J.* 1987. Feature Discovery and the Sampling Requirements of Archaeological Evaluations. *Journal of Field Archaeology* 14 (3): 359-371.

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