Spatial Technologies in Anthropology
ASM 568 - 91161
Fall 2015 - Michael Barton

Course Resources

Texts:
Conolly, J., & Lake, M. (2006). *Geographical information systems in archaeology*. Cambridge: Cambridge University Press. **[CL]**

Neteler, M., & Mitasova, H. (2008). *Open Source GIS: a GRASS GIS Approach, 3rd Edition*. New York: Springer. **[NM]** Available as an ebook at: http://link.springer.com.ezproxy1.lib.asu.edu/book/10.1007/978-0-387-68574-8

Wheatley, D., & Gillings, M. (2002). *Spatial Technology and Archaeology: the Archaeological Applications of GIS*. New York: Taylor & Francis. **[WG]**

Recommended:
Bodenhamer, D. J., Corrigan, J., & Harris, T. M. (2010). *The spatial humanities: GIS and the future of humanities scholarship*. Bloomington: Indiana University Press.

Parcak, S. H. (2009). *Satellite Remote Sensing for Archaeology* (1st ed.). Routledge.

Wiseman, J., & El-Baz, F. (2007). *Remote Sensing in Archaeology*. Available as an ebook at: http://www.springerlink.com/content/978-0-387-44453-6/#section=343768&page=1

Other useful books:
Davis, B. E. (2001). *GIS: a visual approach* (2nd ed.). Albany, N.Y.: Delmar Thomson Learning.

Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2007). *Remote sensing and image interpretation* (6th ed.). New York: Wiley.

Lock, G. R. (2000). *Beyond the map: archaeology and spatial technologies*. NATO science series. Series A, Life sciences v. 321. Amsterdam; Washington, DC Tokyo: IOS Press; Ohmsha [distributor].

Smith, M. J. D., Goodchild, M. F., & Longley, P. (2015). Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools (5th ed.). Troubador Publishing Ltd. Free online plus additional resources at: http://www.spatialanalysisonline.com

Westcott, K. L., & Brandon, R. J. (Eds.). (2000). *Practical Applications of GIS for Archaeologist: a Predictive Modeling Kit*. New York: Taylor & Francis.

Free and Open Source Software used in class:
GRASS GIS: (Geographic Resource Analysis Support System) This software can be downloaded in versions for Windows, Mac OS X, and Linux from the International GRASS Development Center at http://grass.osgeo.org. GRASS includes raster and vector GIS, spatial analysis and modeling, single-band and multispectral image analysis, and digitizing modules. GRASS is open source software and available free of charge. I recommend using version 7. I also recommend that you download the North Carolina and Spearfish, ND demo data sets too.

FIJI/ImageJ: General purpose image processing software: including enhancement, image math, filtering, and analysis. Many plugins available that add features. ImageJ is available for download at: http://rsb.info.nih.gov/ij/index.html. FIJI is a version of

ImageJ that comes packaged with a lot of useful plugins already installed. You can download it at: http://fiji.sc/wiki/index.php/Fiji.

MultiSpec: Image analysis software, apecifically designed for working with multispectral remote images. Includes enhancement, rectification, image math, and supervised/unsupervised classification. Available in the public domain for download at https://engineering.purdue.edu/~biehl/MultiSpec/

GeoDa: (Geospatial Data Analysis) Software designed for interactive spatial data analysis using visual and statistical tools. Using vector GIS data, it combines analytical maps with spatial statistics. Developed here at ASU. It is available at: https://geodacenter.asu.edu/.

Other Free and Open Source Software:
QGIS: Another open source GIS package available free of charge, QGIS is available in versions for Windows, Mac OS X, Linux, and Unix from http://qgis.org/. It is primarily an easy to use vector GIS, including thematic mapping. It can display raster layers under the vectors. It has limited raster analytical capabilities by itself. But with the GRASS plug-in installed, it has access to many of the analytical and raster processing functions of GRASS.

GvSIG: (Generalitat de Valencia, Sistema de Información Geográphica) Full featured GIS and geospatial analysis package (with Sextant plugin). Developed by the Valencian (Spain) government, it is especially strong in accessing web-based spatial data (e.g., via WMS servers). An English version with improved useability has been developed by Oxford Archaeology Digital at: http://oadigital.net/software/gvsigoade

R + RStudio, with packages like ***sp, rgeos, tmap, raster, rgdal, and rasterVis***: R is generally thought of as a statistics package, and it is a very good one. But it goes far beyond statistics and is a general-purpose quantitative analysis, visualization, data management, and programming environment. It has very powerful spatial analysis tools and versatile, publication quality cartography. It's main drawback is a lack of interactive visualization. Rstudio is a program that makes R much easier to use. R can be downloaded at: https://cran.r-project.org and RStudio is available at: https://www.rstudio.com/products/RStudio/ There are R packages to connect with GRASS, QGIS, and ArcGIS. Here are a few sites and a book with more info about using R for spatial analysis and visualization: https://github.com/Robinlovelace/Creating-maps-in-R; http://pakillo.github.io/R-GIS-tutorial/; https://cran.r-project.org/web/views/Spatial.html; https://us.sagepub.com/en-us/nam/an-introduction-to-r-for-spatial-analysis-and-mapping/book241031

LibreOffice: An office suite (like Microsoft Office) for Windows, Mac, and Linux. It's database and spreadsheet modules are excellent tools for creating data that can be used in a GIS. It also has a very good drawing module for dressing up maps, along with a good http://www.r-bloggers.com/r-an-integrated-statistical-programming-environment-and-gis/wordproccessor and presentation package (like powepoint). It can be downloaded at http://www.libreoffice.org/.

Commercial software:
***ArcGIS GIS*:** This software is available on the academic network at ASU, in the Anthropology Department computer laboratory. Current versions are for Windows only. Students can purchase ArcGIS for a steep discount from the commercial price at ASU. You will need at least three modules for a reasonably complete system (primary ArcView module, Spatial Analyst, and Image Analyst) that includes raster and vector GIS, spatial analysis and modeling, image analysis, and digitizing modules.

Idrisi GIS: This software can be purchased from Clark Labs, Clark University (http://idrisi.com/). The program is available for Windows only. Students can purchase

the software for a substantial discount over the commercial price. Idrisi includes raster and vector GIS, spatial analysis and modeling, and single-band and multispectral image analysis. The base price includes all modules except digitizing, which is in the separate CartaLinx module. Idrisi can import data from a wide variety of other sources.

Additional Resources:
Website for Neteler and Mitasova book . Short courses, demo data link, examples, and errata.http://www.grassbook.org/data_menu3rd.php

Course at NCSU by Helena Mitasova at
http://courses.ncsu.edu/gis582/common/index.html

Demo datasets for GRASS: GRASS demo dataset from North Carolina and Spearfish, ND will be used for examples and some assignments. Available for download from the GRASS GIS downloads site (see above). Also available from the Neteler and Mitasova book web site.

Demo datasets for GeoDa: for 16 September lab practicum can be downloaded at: https://geodacenter.asu.edu/sdata and on Blackboard.

Geospatial data on the internet **(see Blackboard)**

Course Objectives, Organization, and Grading

Students should gain a basic understanding of the concepts underlying the operation of geographic information systems, the analysis of digital images, and the acquisition and use of geophysical data and remotely sensed (i.e., spaceborne and airborne platforms) imagery. Students also will learn how to apply these concepts to real-world data by using GIS, image analysis, and multispectral image analysis software. Finally, students will explore how these software tools can be applied to spatial anthropological data.

Class sessions will generally be divided between a **seminar** discussion section, to review GIS and remote sensing concepts and critically evaluate articles that exemplify GIS and remote sensing methodologies in anthropology, and a "**lab practicum**" section where we will work hands on to try GIS or image analysis techniques in a setting where students can work together and ask questions. In the discussion section, I may start by ilustrating some concepts and/or examples.

Readings for each class session include:

- General methodology and application from the Wheatley & Gillings and Conolly & Lake texts. These are references for methods and their applications. We won't plan to discuss these explicitly, but can talk about them in class when there are questions.
- Articles that exemplify GIS use in anthropological research which we will discuss in class. These will be the basis for the seminar-like discussion. You will need to read the assigned articles so as to not feel embarrassed in front of your peers who DID read them.
- Sections from Neteler & Mitasova, and online sources that explain how to carry out particular procedures in the course software. I've indicated readings that will be helpful in the lab practicum section and for working on projects. Avoid reading these at your own risk.

Course grades will be based on the following:

1. three short projects that will focus on the application of GIS and image analysis techniques to small, test data sets (45%);
2. the completion and presentation of a conference-quality poster or written paper presenting the results of anthropological research employing GIS and/or remote sensing methods (40%); and
3. active participation in class discussion and lab practica (15%).

Student Standards for Academic Integrity and Behavior

Student Standards: Students are required to read and act in accordance with university and Arizona Board of Regents policies, including:

- The Academic Integrity Policy: https://provost.asu.edu/index.php?q=academicintegrity
- The Student Code of Conduct: Arizona Board of Regents Policies 5-301 through 5-308: https://students.asu.edu/srr/code
- The Computer, Internet and Electronic Communications Policy: http://www.asu.edu/aad/manuals/acd/acd125.html

If you fail to meet the standards of academic integrity in any of the criteria listed on the university policy website, sanctions will be imposed by the instructor, school, and/or dean. Academic dishonesty includes borrowing ideas without proper citation, copying others' work (including information posted on the internet), and failing to turn in your own work for group projects. If you follow an argument closely or quote a source directly, you *must* provide a citation to the publication, including the author, date and page number. If you directly quote a source, even in an assignment, you must use quotation marks and a page number citation for each quoted sentence or phrase.

You may work with other students on assignments, however, all work that you do and writing that you turn in must be done independently. If you have any doubt about whether the form of cooperation you contemplate is acceptable, ask the instructor ***in advance of turning in an assignment.***

Prohibition of Commercial Note Taking Services: In accordance with ACD 304-06 Commercial Note Taking Services, written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the notetaker's name as well as the instructor's name, the course number, and the date.

Sexual Violence/Harassment: Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at http://sexualviolenceprevention.asu.edu/faqs/students.

Syllabus and Reading List

8/26 **Introduction to Spatial Technologies**
[WG] chapt. 1 (Archaeology, Space, and GIS).
[CL] chapt. 1, 3

For discussion:
Anemone, R. l., Conroy, G. C., & Emerson, C. W. (2011). GIS and paleoanthropology: Incorporating new approaches from the geospatial sciences in the analysis of primate and human evolution. *American Journal of Physical Anthropology*, 146(S53), 19–46. doi:10.1002/ajpa.21609

Harris, T. M., Corrigan, J., & Bodenhamer, D. J. (2010). Challenges for the spatial humanities: toward a research agenda. In D. J. Bodenhamer, J. Corrigan, & T. M. Harris (Eds.), *The spatial humanities: GIS and the future of humanities scholarship* (pp. 167–176). Bloomington: Indiana University Press.

Llobera, M. (2012). Life on a Pixel: Challenges in the Development of Digital Methods Within an "Interpretive" Landscape Archaeology Framework. *Journal of Archaeological Method and Theory*. doi:10.1007/s10816-012-9139-2

McCoy, M. D., & Ladefoged, T. N. (2009). New Developments in the Use of Spatial Technology in Archaeology. *Journal of Archaeological Research*, *17*(3), 263–295. doi:10.1007/s10814-009-9030-1

For further reading:
Harris, T. M. (2006). Scale as Artifact: GIS, Ecological Fallacy, and Archaeological Analysis. In G. Lock & B. L. Molyneaux (Eds.), *Confronting scale in archaeology* (pp. 39–53). Springer US. Retrieved from http://www.springerlink.com/index/10.1007/0-387-32772-3_3

Kvamme, K. L. (1999). Recent Directions and Developments in Geographical Information Systems. *Journal of Archaeological Research*, *7*, 153–201.

Logan, J. R. (2012). Making a Place for Space: Spatial Thinking in Social Science. *Annual Review of Sociology*, 38. http://doi.org/10.1146/annurev-soc-071811-145531

Lab practicum: introduction to GRASS
[NM] chapt. 1-3

Neteler, M., Bowman, M. H., Landa, M., & Metz, M. (2012). GRASS GIS: A multi-purpose open source GIS. *Environmental Modelling & Software*, 31, 124–130. http://doi.org/10.1016/j.envsoft.2011.11.014

9/2 **Spatial data: rasters, vectors, and attributes**
[WG] chapt. 2 (The Spatial Database)
[CL] chapt. 2

For discussion:
Harrower, M. J. (2010). Geographic Information Systems (GIS) hydrological modeling in archaeology: an example from the origins of irrigation in Southwest Arabia (Yemen). *Journal of Archaeological Science*, *37*(7), 1447–1452. doi:10.1016/j.jas.2010.01.004

Goodchild, M. F. (2013). Prospects for a Space–Time GIS. *Annals of the Association of American Geographers*, 103(5), 1072–1077. http://doi.org/10.1080/00045608.2013.792175

Hill, J. B. (2000). Decision making at the margins: settlement trends, temporal scale, and ecology in the Wadi al Hasa, west-central Jordan. *Journal of Anthropological Archaeology*, *19*, 221–241.

For further reading
Stonich, S. (1996). Integrating socioeconomic and geographic information systems: a methodology for rural development and agricultural policy design. In *Anthropology, Space, and Geographic Information Systems*, edited by M. Aldenderfer and D.G. Maschner, pp. 78-96. Oxford University Press, Oxford.

Lab practicum: exploring spatial data (topology, attributes, and reports)
[NM] chapt. 4

9/9 **Building a GIS: overlays, projections, and georegistration**
[WG] chapt. 3 (Acquiring and Integrating Data).
[CL] chapt 4-5

For discussion:
Bevan, A. and J. Conolly (2004). GIS, Archaeological Survey, and Landscape Archaeology on the Island of Kythera, Greece. Journal of Field Archaeology 29(1/2):123-138.

Kemp, K. K. (2010). Geographic information science and spatial analysis for the humanities. In D. J. Bodenhamer, J. Corrigan, & T. M. Harris (Eds.), *The spatial humanities: GIS and the future of humanities scholarship* (pp. 31–57). Bloomington: Indiana University Press.

Morehart, C. T. (2012). Mapping ancient chinampa landscapes in the Basin of Mexico: a remote sensing and GIS approach. Journal of Archaeological Science, 39(7), 2541–2551. doi:10.1016/j.jas.2012.03.001

For further reading:
Forte, M. (2000). Archaeology and virtual micro-topography: the creation of DEMs for reconstructing fossil landscapes by remote sensing and GIS applications. In *Beyond the map : archaeology and spatial technologies*. Edited by G. R. Lock. Amsterdam ; Washington, DC; Tokyo, IOS Press; Ohmsha [distributor] pp. 199-213.

Giannini, F., M. T. Pareschi, et al. (2000). Ancient and new Pompeii: a project for monitoring archaeological sites in densely populated areas. In *Beyond the map: archaeology and spatial technologies*. Edited by G. R. Lock. Amsterdam; Washington, DC, Tokyo, IOS Press; Ohmsha [distributor] pp. 187-198.

Lab practicum: downloading data and creating a GIS
***** Start project 1 *****

9/16 **Thematic maps: visualizing quantitative information. Guest presentation by Julia Koschinsky, SGSUP and ASU GeoDa Center for Geospatial Analysis and Computation**

[WG] chapt. 4
[CL] chapt 7.1-7.2, 12

Anselin, L., Syabri, I., & Kho, Y. (2006). GeoDa: An Introduction to Spatial Data Analysis. *Geographical Analysis*, 38(1), 5–22. http://doi.org/10.1111/j.0016-7363.2005.00671.x

Make sure you install GeoDa (https://geodacenter.asu.edu/software/downloads) and sample data (https://geodacenter.asu.edu/sdata)

For discussion:
Anselin, L. (1995). Local Indicators of Spatial Association-LISA. *Geographical Analysis*, *27*(2), 93–115. doi:10.1111/j.1538-4632.1995.tb00338.x

Gallotti, R. (2011). GIS and Intra-Site Spatial Analyses: An Integrated Approach for Recording and Analyzing the Fossil Deposits at Casablanca Prehistoric Sites (Morocco). *Journal of Geographic Information System*, *03*(04), 373–381. doi:10.4236/jgis.2011.34036

Mainland, I., Card, N., Saunders, M. K., Webster, C., Isaksen, L., Downes, J., & Littlewood, M. (2014). "SmartFauna": a microscale GIS-based multi-dimensional approach to faunal deposition at the Ness of Brodgar, Orkney. *Journal of Archaeological Science*, 41, 868–878. http://doi.org/10.1016/j.jas.2013.10.019

For further reading
Stoner, W. D. (2012). Modeling and testing polity boundaries in the Classic Tuxtla Mountains, Southern Veracruz, Mexico. Journal of Anthropological Archaeology, 31(3), 381–402. doi:10.1016/j.jaa.2012.03.004

Vermeulen, F., M. Antrop, et al. (2001). Ancient roads and fields in northwestern Gaul—a GIS-based approach. In *Computing Archaeology for Understanding the Past, CAA 2000: computer applications and quantitative methods in archaeology. Proceedings of the 28th Conference, Ljubljana, April 2000*. Edited by Z. Stancic and T. Veljanovski. Oxford, Archaeopress pp. 187-196.

Yuan, M. (2010). Mapping text. In D. J. Bodenhamer, J. Corrigan, & T. M. Harris (Eds.), *The spatial humanities: GIS a¡™ nd the future of humanities scholarship* (pp. 109–123). Bloomington: Indiana University Press.

Lab practicum: thematic maps and spatial analysis with GeoDa
[NM] chapt. 6.0-6.7
GeoDa tutorials at: https://geodacenter.asu.edu/learning/tutorials

9/23 **Spatial relationships (vectors and rasters)**
[WG] chapt. 4, chapt. 7 (pp. 147-148).
PROJECT 1 DUE

For discussion:
Marean, C. W., Y. Abe, et al. (2001). Estimating the minimum number of skeletal elements (MNE) in zooarchaeology: a review and a new image-analysis GIS approach. *American Antiquity* 66(2): 333-348.

Peeples, M., C. M. Barton, et al. (2006). Resilience lost: intersecting landuse and landscape dynamics in the upland southwest. *Ecology and Society* 12(22).

Shaffer, C. A. (2013). Gis analysis of patch use and group cohesiveness of bearded sakis (chiropotes sagulatus) in the upper essequibo conservation concession, guyana. American Journal of Physical Anthropology, 150(2), 235–246. http://doi.org/10.1002/ajpa.22197

For further reading:
Elliott, M. (2005). Evaluating evidence for warfare and environmental stress in settlement pattern data from the Malpaso valley, Zacatecas, Mexico. *Journal of Anthropological Archaeology* 24(4): 297-315.

Jones, E. E. (2010). An analysis of factors influencing sixteenth and seventeenth century Haudenosaunee (Iroquois) settlement locations. *Journal of Anthropological Archaeology*, 29(1), 1–14. doi:10.1016/j.jaa.2009.09.

Miller, A., & Barton, C. M. (2008). Exploring the land: a comparison of land-use patterns in the Middle and Upper Paleolithic of the western Mediterranean. *Journal of Archaeological Science*, 35, 1427–1437. http://doi.org/10.1016/j.jas.2007.10.007

Lab practicum: overlays and buffers
[NM] chapts 5.1, 5.4, 6.5 (and others of your choosing in chapts. 5 and 6)

9/30 **DEMs and terrain analysis**
[WG] chapt. 5
[CL] chapt 9

For discussion:
Bunn, J. M., & Ungar, P. S. (2009). Dental topography and diets of four old world monkey species. *American Journal of Primatology*, 71(6), 466–477. doi:10.1002/ajp.20676

Mitasova, H., Harmon, R. S., Weaver, K. J., Lyons, N. J., & Overton, M. F. (2012). Scientific visualization of landscapes and landforms. *Geomorphology*, *137*(1), 122–137. doi:10.1016/j.geomorph.2010.09.033

Wienhold, M. L. (2013). Prehistoric land use and hydrology: a multi-scalar spatial analysis in central Arizona. *Journal of Archaeological Science*, 40(2), 850–859. http://doi.org/10.1016/j.jas.2012.10.010

For further reading
Field, J. S. (2004). Environmental and climatic considerations: a hypothesis for conflict and the emergence of social complexity in Fijian prehistory. Journal of Anthropological Archaeology, 23(1), 79–99. http://doi.org/10.1016/j.jaa.2003.12.004

Lock, G.R. and T.M. Harris (1996). Danebury Revisited: an English Iron Age Hillfort in a Digital Landscape. In *Anthropology, Space, and Geographic Information Systems*, edited by M. Aldenderfer and D.G. Maschner, pp. 214-240. Oxford University Press, Oxford.

Miller, A., & Barton, C. M. (2008). Exploring the land: a comparison of land-use patterns in the Middle and Upper Paleolithic of the western Mediterranean. Journal of Archaeological Science, 35, 1427–1437. http://doi.org/10.1016/j.jas.2007.10.007

Mitasova, H., Hardin, E., Starek, M., Harmon, R. S., & Overton, M. F. (2011). Landscape dynamics from LiDAR data time series. In T. Hengl, I. Evans, J. Wilson, & M. Gould (Eds.), *Geomophometry* 2011 (pp. 3–6). Redlands, CA.

Roughley, C. (2001). Understanding the Neolithic landscape of the Carnac region: a GIS approach. In *Computing Archaeology for Understanding the Past, CAA 2000: computer applications and quantitative methods in archaeology. Proceedings of the 28th Conference, Ljubljana, April 2000*. Edited by Z. Stancic and T. Veljanovski. Oxford, Archaeopress.

Lab practicum: DEMs and terrain analysis
[NM] chapt. 5.0-5.4.2
Start Project 2

10/7 **Interpolating surfaces from points**
[WG], chapt. 6, 9
[CL] chapt 6

For discussion:
Challis, K., Forlin, P., & Kincey, M. (2011). A Generic Toolkit for the Visualization of Archaeological Features on Airborne LiDAR Elevation Data: Visualizing Archaeological Features in Airborne LiDAR. *Archaeological Prospection*, *18*(4), 279–289. http://doi.org/10.1002/arp.421

Clarkson, C., & Bellas, A. (2014). Mapping stone: using GIS spatial modelling to predict lithic source zones. Journal of Archaeological Science, 46, 324–333. http://doi.org/10.1016/j.jas.2014.03.035

Costa, J. A., Lima da Costa, M., & Kern, D. C. (2013). Analysis of the spatial distribution of geochemical signatures for the identification of prehistoric settlement patterns in ADE and TMA sites in the lower Amazon Basin. Journal of Archaeological Science, 40(6), 2771–2782. http://doi.org/10.1016/j.jas.2012.12.027

For further reading:
Boaz, J. (2000). Quantifying the non-quantifiable: studying hunter-gatherer landscapes. In *Beyond the map : archaeology and spatial technologies*. Edited by G. R. Lock. Amsterdam ; Washington, DC; Tokyo, IOS Press ;Ohmsha [distributor] pp. 101-115.

Chase, A. F., Chase, D. Z., Fisher, C. T., Leisz, S. J., & Weishampel, J. F. (2012). Geospatial revolution and remote sensing LiDAR in Mesoamerican archaeology. *Proceedings of the National Academy of Sciences*, 109(32), 12916 –12921. doi:10.1073/pnas.1205198109

Davidson, P. J., Scholar, S., & Howe, M. (2011). A GIS-based methodology for improving needle exchange service delivery. *International Journal of Drug Policy*, *22*(2), 140–144. doi:10.1016/j.drugpo.2010.10.003

Loebel, T. J. (2012). Pattern or bias? A critical evaluation of Midwestern fluted point distributions using raster based GIS. *Journal of Archaeological Science*, *39*(5), 1205–1217. doi:10.1016/j.jas.2011.12.012

Robinson, J. and E. Zubrow (1999). Between spaces: interpolation in archaeology. In *Geographical information systems and landscape archaeology*. Edited by M. Gillings, D. Mattingly and J. v. Dalen. Oxford, Oxbow Books pp. 65-83.

Lab practicum: points and interpolation

[NM] chapt. 6.8-6.10.3

10/14 **Territories and movement**
[WG] chapt. 7
[CL] chapt 10.1-10.3.1
PROJECT 2 DUE

For discussion:

Altaweel, M. R., & Wu, Y. (2010). Route Selection and Pedestrian Traffic: Applying an Integrated Modeling Approach to Understanding Movement. *Structure and Dynamics*, *4*(2).

Leidwanger, J. (2013). Modeling distance with time in ancient Mediterranean seafaring: a GIS application for the interpretation of maritime connectivity. *Journal of Archaeological Science*, *40*(8), 3302–3308. http://doi.org/10.1016/j.jas.2013.03.016

Ullah, I. I. T. (2011). A GIS method for assessing the zone of human-environmental impact around archaeological sites: a test case from the Late Neolithic of Wadi Ziqlâb, Jordan. *Journal of Archaeological Science*, *38*(3), 623–632. doi:10.1016/j.jas.2010.10.015

White, D. A., & Barber, S. B. (2012). Geospatial modeling of pedestrian transportation networks: a case study from precolumbian Oaxaca, Mexico. Journal of Archaeological Science, 39(8), 2684–2696. http://doi.org/10.1016/j.jas.2012.04.017

For further reading

De Silva, M. and G. Pizziolo (2001). Setting up a "human calibrated" anisotropic cost surface for archaeological landscape investigation. In *Computing Archaeology for Understanding the Past, CAA 98 : computer applications and quantitative methods in archaeology ; proceedings of the 28th Conference, Ljubljana, April 2000*. Edited by Z. Stancic and T. Veljanovski. Oxford, Archaeopress pp. 279-286.

Faust, K., B. Entwisle, et al. (2000). Spatial arrangement of social and economic networks among villages in Nang Rong District, Thailand. *Social Networks* 21(4): 311-337.

Hare, T. S. (2004). Using measures of cost distance in the estimation of polity boundaries in the Postclassic Yautepec valley, Mexico. Journal of Archaeological Science, 31(6), 799–814. http://doi.org/10.1016/j.jas.2003.10.016

Howey, M. C. L. (2011). Multiple pathways across past landscapes: circuit theory as a complementary geospatial method to least cost path for modeling past movement. *Journal of Archaeological Science*, 38(10), 2523–2535. http://doi.org/10.1016/j.jas.2011.03.024

Richards-Rissetto, H., & Landau, K. (2014). Movement as a means of social (re)production: using GIS to measure social integration across urban landscapes. *Journal of Archaeological Science*, *41*, 365–375. http://doi.org/10.1016/j.jas.2013.08.006

Whitley, T. G., & Hicks, L. M. (2003). A geographic information systems approach to understanding potential prehistoric and historic travel corridors. *Southeastern Archaeology*, 22(1), 77–91. http://doi.org/Article

Lab practicum: cost surfaces and least cost paths
[NM] chapt. 5.4.3

10/21 Visibility and perception
[WG] chapt. 10
[CL] chapt 10.3.2-10.4

For discussion:
Bongers, J., Arkush, E., & Harrower, M. (2012). Landscapes of death: GIS-based analyses of chullpas in the western Lake Titicaca basin. *Journal of Archaeological Science*, *39*(6), 1687–1693. doi:10.1016/j.jas.2011.11.018

Gillings, M. (2015). Mapping invisibility: GIS approaches to the analysis of hiding and seclusion. *Journal of Archaeological Science*, *62*, 1–14. http://doi.org/10.1016/j.jas.2015.06.015

Ogburn, D. E. (2006). Assessing the level of visibility of cultural objects in past landscapes. *Journal of Archaeological Science*, *33*(3), 405–413. doi:10.1016/j.jas.2005.08.005

For further reading:
Llobera, M. (2007). Reconstructing visual landscapes. *World Archaeology*, *39*(1), 51–69. doi:10.1080/00438240601136496

Tschan, A. P., W. Raczkowski, et al. (2000). Perception and viewsheds: are they mutually inclusive? In *Beyond the map : archaeology and spatial technologies*. Edited by G. R. Lock. Amsterdam ; Washington, DC; Tokyo, IOS Press ; Ohmsha [distributor] pp. 28-48.

Wheatley, D. (1995). Cumulative viewshed analysis: a GIS-based method for investigating intervisibility, and its archaeological application. In *Archaeology and Geographical Information Systems: a European Perspective*, edited by G. Lock and Z. Stancic, pp. 171-185. Taylor & Francis, London.

Witcher, R. E. (1999). GIS and landscapes of perception. In *Geographical information systems and landscape archaeology*. Edited by M. Gillings, D. Mattingly and J. v. Dalen. Oxford, Oxbow Books pp. 13-22.

Lab practicum: viewsheds and line of sight
[NM] chapt. 5.4.4
Start Project 3

10/28 **Locational modeling and settlement analysis**
[WG] chapt. 8
[CL] chapt 8

For discussion:
Barton, C. M., Bernabeu Auban, J., Garcia Puchol, O., Schmich, S., & Molina Balaguer, L. (2004). Long-term socioecology and contingent landscapes. *Journal of Archaeological Method and Theory,* 11(3), 253–295.

Duke, C., & Steele, J. (2010). Geology and lithic procurement in Upper Palaeolithic Europe: a weights-of-evidence based GIS model of lithic resource potential. *Journal of Archaeological Science*, 37(4), 813–824. doi:10.1016/j.jas.2009.11.011

Stirn, M. (2014). Modeling site location patterns amongst late-prehistoric villages in the Wind River Range, Wyoming. Journal of Archaeological Science, 41, 523–532. http://doi.org/10.1016/j.jas.2013.09.018

For further reading:
Kamermans, H. (2000). Land evaluation as predictive modeling: a deductive approach. In Beyond the map : archaeology and spatial technologies. Edited by G. R. Lock. Amsterdam ; Washington, DC; Tokyo, IOS Press ;Ohmsha [distributor] pp. 124-147.

Warren, R. E. and D. L. Asch (2000). A predictive model of archaeological site location in the eastern Prarie Peninsula. In *Practical Applications of GIS for Archaeologist: a Predictive Modeling Kit*. Edited by K. L. Westcott and R. J. Brandon. New York, Taylor & Francis pp. 5-32.

Westcott, K. L. and J. A. Kuiper (2000). Using a GIS to model prehistoric site distributions in the upper Chesapeake Bay. In *Practical Applications of GIS for Archaeologist: a Predictive Modeling Kit*. Edited by K. L. Westcott and R. J. Brandon. New York, Taylor & Francis pp. 59-72.

Verhagen, P., & Drăguţ, L. (2012). Object-based landform delineation and classification from DEMs for archaeological predictive mapping. *Journal of Archaeological Science*, *39*(3), 698–703. http://doi.org/10.1016/j.jas.2011.11.001

Lab practicum: using the map algebra with the map calculator
[NM] chapt. 5.4.3-5.5.3
Start Project 3

11/4 **Modeling landscapes and land-use. Guest presentation by Isaac Ullah, SHESC.**
[WG] chapt. 12
[CL] chapt 7.3-7.5
PROJECT 3 DUE

For discussion:
Barton, C. M., Ullah, I., & Heimsath, A. (2015). How to Make a Barranco: Modeling Erosion and Land-Use in Mediterranean Landscapes. Land, 4(3), 578–606. http://doi.org/10.3390/land4030578

Parker, D. C., Manson, S. M., Janssen, M. A., Hoffmann, M. J., & Deadman, P. J. (2003). Multi-agent systems for the simulation of land-use and land-cover change: a review. Annals of the Association of American Geographers, 93(2), 314–337.

Siart, C., Bakti, B. B., & Eitel, B. (2013). Digital Geoarchaeology: An Approach to Reconstructing Ancient Landscapes at the Human-Environmental Interface. In H. G. Bock, W. Jäger, & M. J. Winckler (Eds.), Scientific Computing and Cultural Heritage (Vol. 3, pp. 71–84). Berlin, Heidelberg: Springer Berlin Heidelberg. Retrieved from http://link.springer.com/10.1007/978-3-642-28021-4_8

For further reading
Fisher, E. C., Bar-Matthews, M., Jerardino, A., & Marean, C. W. (2010). Middle and Late Pleistocene paleoscape modeling along the southern coast of South Africa. *Quaternary Science Reviews*, *29*(11-12), 1382–1398. doi:10.1016/j.quascirev.2010.01.015

Grohmann, C. H., Riccomini, C., & Chamani, M. A. C. (2011). Regional scale analysis of landform configuration with base-level (isobase) maps. *Hydrol. Earth Syst. Sci*, *15*, 1493–1504.

Rennell, R. (2012). Landscape, Experience and GIS: Exploring the Potential for Methodological Dialogue. J*ournal of Archaeological Method and Theory*. doi:10.1007/s10816-012-9144-5

Williams, I., W.F. Limp, and F.L. Briuer (1990). Using geographic information systems and exploratory data analysis for archaeological site classification and analysis. In *Interpreting Space: GIS and Archaeology*, edited by K.M.S. Allen, S.W. Green, and E.B.W. Zubrow, pp. 239-273. Taylor & Francis, London

Lab practicum: EDA and visualization
[NM] chapt. 7

11/11 **Veteran's Day – No Class**

11/18 **Geophysical survey: remote sensing of locales. Guest presentation by Wendy Cegielski, SHESC.**

For discussion:
Gaffney, C. (2008). Detecting trends in the prediction of the buried past: a review of geophysical techniques in archaeology. *Archaeometry*, *50*(2), 313–336. doi:10.1111/j.1475-4754.2008.00388.x

Kvamme, K. (2007). Integrating Multiple Geophysical Datasets. *Remote Sensing in Archaeology* (pp. 345–374). Retrieved from http://dx.doi.org.ezproxy1.lib.asu.edu/10.1007/0-387-44455-6_14

Rego, J. P., & Cegielski, W. H. (2014). Gradiometry survey and magnetic anomaly testing of Castros de Neixón, Galicia, Spain. Journal of Archaeological Science, 46, 417–427. http://doi.org/10.1016/j.jas.2014.01.023

Lab practicum: working with geophysical survey data

For further reading:
De Smedt, P., Van Meirvenne, M., Saey, T., Baldwin, E., Gaffney, C., & Gaffney, V. (2014). Unveiling the prehistoric landscape at Stonehenge through multi-receiver EMI. *Journal of Archaeological Science*, 50, 16–23. http://doi.org/10.1016/j.jas.2014.06.020

11/25 **Remote sensing of landscapes**
[Parcak] chapt 2 (scan), 3 and 4

For discussion:
Alexakis, D., Sarris, A., Astaras, T., & Albanakis, K. (2011). Integrated GIS, remote sensing and geomorphologic approaches for the reconstruction of the landscape habitation of Thessaly during the neolithic period. *Journal of Archaeological Science*, *38*(1), 89–100. doi:10.1016/j.jas.2010.08.013

Lasaponara, R., & Masini, N. (2012). Investigating Satellite Landsat TM and ASTER Multitemporal Data Set to Discover Ancient Canals and Acqueduct Systems. In B. Murgante, O. Gervasi, S. Misra, N. Nedjah, A. M. A. C. Rocha, D. Taniar, & B. O. Apduhan (Eds.), *Computational Science and Its Applications – ICCSA 2012* (pp. 497–511). Springer Berlin Heidelberg. Retrieved from http://link.springer.com.ezproxy1.lib.asu.edu/chapter/10.1007/978-3-642-31137-6_38

Noviello, M., Ciminale, M., & De Pasquale, V. (2013). Combined application of pansharpening and enhancement methods to improve archaeological cropmark visibility and identification in QuickBird imagery: two case studies from Apulia, Southern Italy. *Journal of Archaeological Science*, *40*(10), 3604–3613. http://doi.org/10.1016/j.jas.2013.04.013

For further reading:
Amarsaikhan, D., & Douglas, T. (2004). Data fusion and multisource image classification. *International Journal of Remote Sensing*, 25(17), 3529–3539.

Fowler, M. J. F. (2002). Satellite remote sensing and archaeology : a comparative study of satellite imagery of the environs of Figsbury Ring, Wiltshire. *Archaeological Prospection* 9(2): 55-69.

Harrower, M., J. McCorriston, et al. (2002). Mapping the roots of agriculture in southern Arabia: the application of satellite remote sensing, global positioning system and geographic information system technologies. *Archaeological Prospection* 9(1): 35-42.

Heckenberger, M. J., Christian Russell, J., Toney, J. R., & Schmidt, M. J. (2007). The legacy of cultural landscapes in the Brazilian Amazon: implications for biodiversity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *362*(1478), 197–208. doi:10.1098/rstb.2006.19

Ur, J. (2003). CORONA Satellite Photography and Ancient Road Networks: A Northern Mesopotamian Case Study. *Antiquity*, *77*(295), 102–115.

Lab practicum: image enhancement and data fusion
[NM] chapt. 8
Canada Centre for Remote Sensing, "Fundamentals of Remote Sensing" at http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/educational-resources/9309

12/2 **Multivariate methods for spatial data**
Multispec: Tutorial example in "An Introduction to MultiSpec", available for download at https://engineering.purdue.edu/~biehl/MultiSpec/tutorials.html

For discussion:
Abson, D. J., Dougill, A. J., & Stringer, L. C. (2012). Using Principal Component Analysis for information-rich socio-ecological vulnerability mapping in Southern Africa. *Applied Geography*, *35*(1-2), 515–524. http://doi.org/10.1016/j.apgeog.2012.08.004

Hill, J. and B. Schutt (2000). "Mapping complex patterns of erosion and stability in dry Mediterranean ecosystems." Remote Sensing of Environment 74(3): 557-569.

Ullah, I. I., Duffy, P. R., & Banning, E. B. (2014). Modernizing Spatial Micro-Refuse Analysis: New Methods for Collecting, Analyzing, and Interpreting the Spatial Patterning of Micro-Refuse from House-Floor Contexts. *Journal of Archaeological Method and Theory*. http://doi.org/10.1007/s10816-014-9223-x

For further reading:
Curran, L. M., Trigg, S. N., McDonald, A. K., Astiani, D., Hardiono, Y. M., Siregar, P., … Kasischke, E. (2004). Lowland Forest Loss in Protected Areas of Indonesian Borneo. *Science*, 303, 1000–1003.

Kobayashi, T., Nakayama, S., Wang, L.-M., Li, G.-Q., & Yang, J. (2005). Socio-ecological analysis of desertification in the Mu-Us Sandy Land with satellite remote sensing. *Landscape and Ecological Engineering*, 1(1), 17–24. http://doi.org/10.1007/s11355-005-0003-3

Mbow, C., T. T. Nielsen, et al. (2000). Savanna Fires in East-Central Senegal: Distribution Patterns, Resource Management and Perceptions. *Human Ecology* 28(4): 561-583.

Lab practicum: unsupervised and supervised classification

12/4 **FINAL PROJECTS DUE**

12/9 **POSTER PRESENTATIONS (tentative)**