DEPARTMENT OF CITY AND REGIONAL PLANNING

University of North Carolina at Chapel Hill

# PLAN 745: Development Impact Assessment

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Spring 2024
9:05 – 10:20 MW (Murphey Hall 202)

Course site: https://canvas.unc.edu/
Course question site: https://pollev.com/bendor

**Course approach and objectives.** Development impact assessments are used for many public and private planning purposes, including evaluation of land use planning alternatives, assessment of private and public development proposals, and marketing of development proposals. In this class, you will learn the skills and techniques needed for predicting, evaluating, and mitigating potential adverse impacts of land development projects, particularly as they affect urban infrastructure. You will also develop skills in documenting and reporting impact assessment analyses, findings, and recommendations in a competent, professional manner. By analyzing and discussing various examples of those applications, the course will help you develop an appreciation of the strengths and limitations of various impact assessment approaches in specific applications. You will also learn to critically approach impact assessment and analyze others' assessments.

The course will meet for two 75-min sessions each week, which will include e lectures, discussions and occasional field trips and guest speakers. While the lectures, field trips, and readings are important, an equally critical aspect of learning in this course comes from your preparation of a range of impact assessments for a variety of different types of development projects.

**What is this syllabus?** This document is many things: 1) It is a planning document, so you can plan your time commitment for reading and assignments. 2) It is a roadmap through the class that aims to give you bearings for each class. 3) It is also a contract of sorts, telling you the level of effort that I intend to put into course as a teacher, as well as the level of effort that I expect from you as a student.

**How can you do well in this class?** To do well in this course, I expect you to spend significant time and effort: 1) working with your group on the impact assessment assignments, and 2) working through the lectures and reading material in advance of class. I also expect you to 3) attend class and **participate** (defined below). Working with a group requires careful scheduling, planning, and division of work and responsibilities; these are all important skills to learn during your time at UNC.

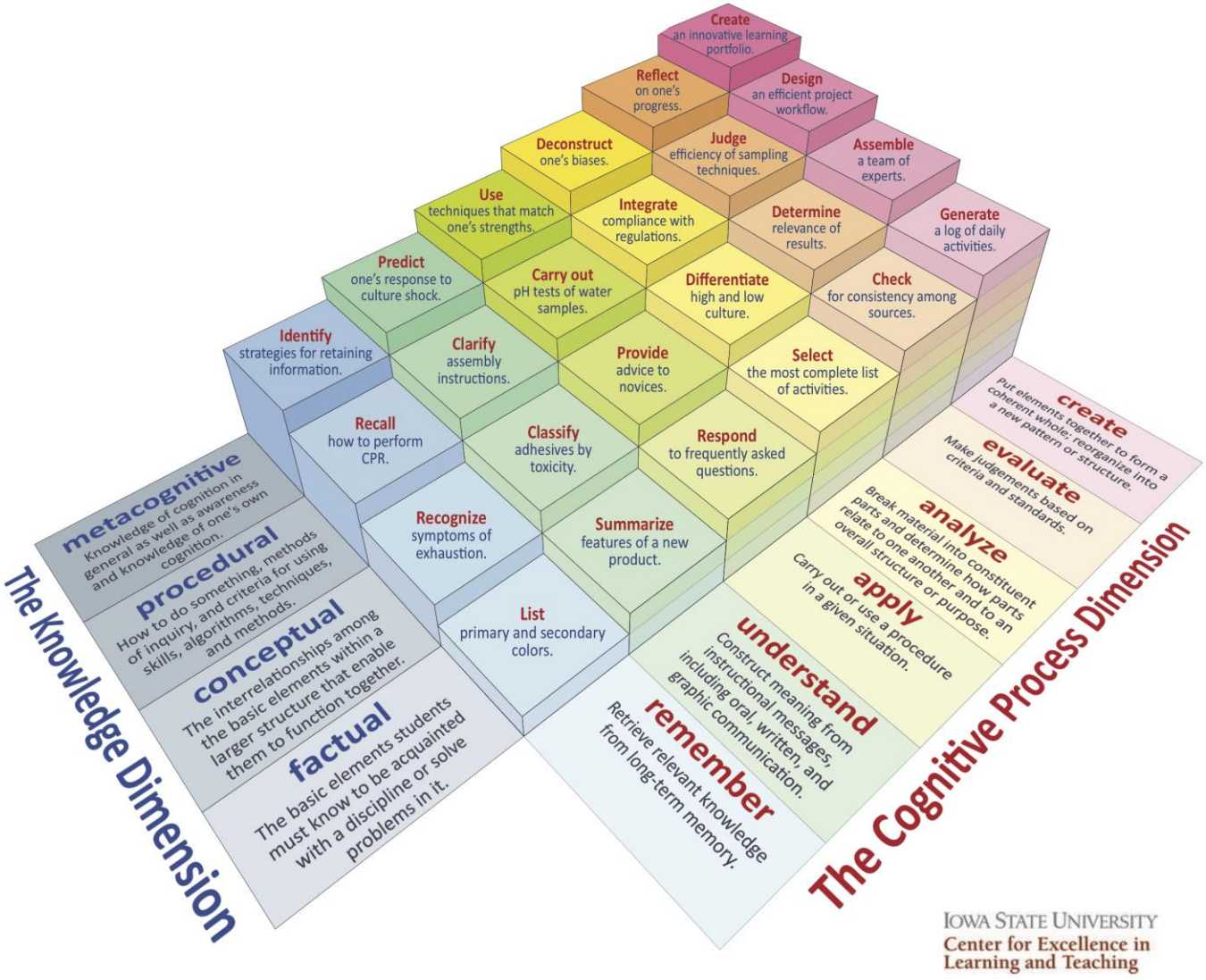
*Time Commitment:* In this course, you should expect to spend at least 3 hours outside of class for each hour you spend in class. This amounts to at least 7-8 hours per week outside of class. It is likely, however, that during some weeks, this course will require much more time, and in other weeks, it will require much less time.

*What is participation?* Participation means that you are actively listening and engaging in classroom discussions, as well as engaging the class with your own questions, whether you bring them in class or through the question website for PLAN 745: https://pollev.com/bendor (your name is not public when you submit!). Please contact the instructor or TA if you have any questions, problems with the readings or the course, or any other issues that you wish to discuss. Students in this class are encouraged to speak up and participate during class meetings.

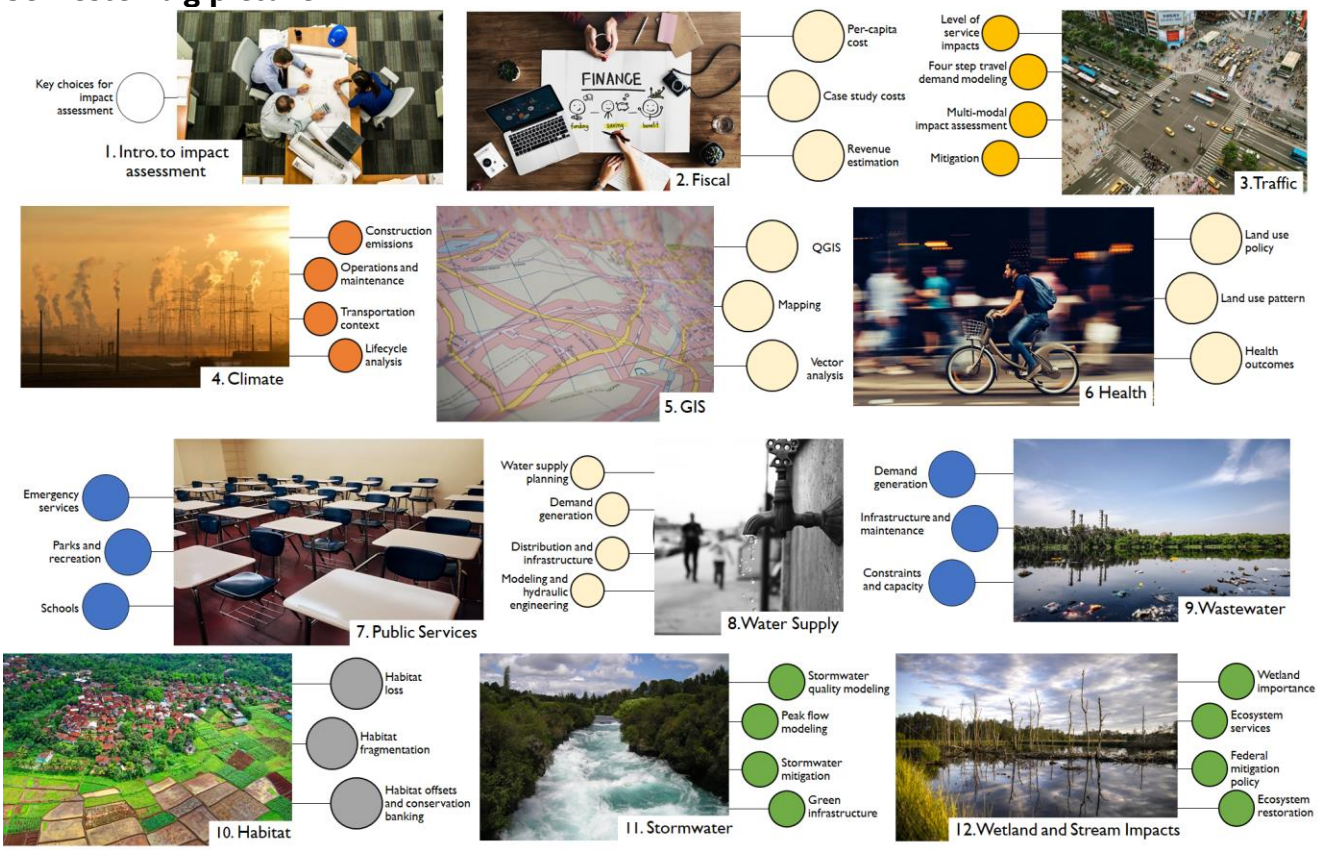
Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class needs to show respect for every other member. I value the perspectives of individuals from all backgrounds reflecting the diversity of our students. I broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. I strive to make this classroom an inclusive space for all students. Please let me know if there is anything I can do to improve, I appreciate suggestions.

*There is a lot of reading. How do I get through it all?* The most important thing to do is plan your time. Some tips:

- If you do not have one, get a calendar! Put all due dates and special class activities (e.g. field trips) on your calendar.
- There are lots of resources for time management available, here is a good one:
  https://students.dartmouth.edu/academic-skills/learning-resources/time-management
- Everyone reads articles differently, you need to figure out how you can effectively read a large volume of material and come away with the main ideas and key points. *"Some books should be tasted, some devoured, but only a few should be chewed and digested thoroughly." – Sir Francis Bacon*. Skimming is your friend and an important strategy to keep up with the readings. However, when you see important points, slow down and digest thoroughly.
- Write down questions as you read! Submit those questions to the course's Poll Everywhere poll: https://pollev.com/bendor. Asking questions is an important part of participating in your own learning process.
- *Why are we **doing** impact assessments?* Bloom's Taxonomy considers educational learning based on different levels of complexity and specificity. Our goal is to climb this "mountain," where the peak means creating new knowledge and synthesizing the plethora of ideas that you have learned in this class. Creation of new knowledge is the goal.



## Semester big picture




## Course requirements and grading

Students will conduct a comprehensive series of assessments for a number of development projects. Your reports will detail your recommendations to the local government for managing the impacts that you identify. To make the impact assessment feasible to conduct in a very short period, much of your assignment material is pre-packaged.

The requirements for this course include:

| | |
|---|---|
| Impact assessment assignments (7 reports) | 70 % |
| Active class participation and attendance | 15 % |
| Grade from your group members | 10 % |
| Grading your group members | 2.5% |
| Linked-In Learning QGIS Module + GIS assignment (individual) | 2.5% |
| Total | 100% |

- Assignments are due **by 9:00am** on due date and must be submitted via Canvas Assignments.
- Complete all (non-GIS) assignments in your groups;
- During submission of each assignment, all group members MUST complete a quick survey evaluating each group member.
- Discussions with additional classmates are encouraged, *but all final work must be entirely your own.*
- The GIS mini-assignment is to be completed individually.

**Assignments**

| | Due date | Topic |
|---|---|---|
| 1 | Feb 5 | Fiscal impacts |
| GIS 1 | Feb 16 | LinkedIn Learning GIS module |
| 2 | Feb 21 | Transportation |
| GIS 2 | Feb 23 | GIS mini-assignment |
| 3 | Mar 1 | Climate change impacts |
| 4 | Mar 8 | Health |
| 5 | Mar 29 | Public services |
| 6 | Apr 15 | Water supply/wastewater impacts |
| 7 | May 3 | Stormwater |

**Field trips**

| Date | Location |
|---|---|
| Mar 27 | Water treatment plant field trip |
| Apr 3 | Wastewater treatment plant field trip |

**Guest speakers**

| | |
|---|---|
| Feb 5 | Bergen Watterson + Sarah Poulton (ToCH) |
| Feb 14 | Noah Kittner (DCRP) |
| Feb 19, 21 | Philip McDaniel (UNC Libraries) |
| Mar 20 | Vishnu Gangadharan (OWASA) |

## Required textbook and readings.

Elmer, Vicki and Adam Leigland. 2014. *Infrastructure Planning and Finance: A Smart and Sustainable Guide*. Routledge. [Available for free to download via UNC Library]

The course's Canvas site contains all other readings, course info, lectures, handouts, data, assignments, and other resources.

**Policy on late/incomplete work.** In order to be fair to your fellow students, **late assignments will be docked 20% per day**.

**Grading Notes.** Generally, an **H** grade is given for exceptional work that demonstrates real mastery of course material. **L** or **F** work fails to meet min. requirements, due to incompleteness, incorrectness, or sloppy or unprofessional reporting of results.

IF YOU HAVE A MEDICAL EMERGENCY, PLEASE INFORM THE INSTRUCTOR AS SOON AS POSSIBLE. Grades of incomplete may be given in the event of a medical or another emergency. In these cases, a written application for an incomplete on any assignment must state the reasons for the request and propose a new deadline.

**The University's Honor Code is in effect.** UNC-Chapel Hill has had a student-administered honor systems and judicial system for over 100 years. The Honor Code represents UNC-Chapel Hill students' commitment to maintain an environment in which all students respect one another and are able to attain their educational goals. As a student at Carolina, you are entering a community in which integrity matters – integrity in the work you submit, and integrity in the manner in which you treat your fellow Carolina community members. Because academic honesty and trustworthiness are important to professional planning, this is a significant University and Departmental tradition. Your attention is called to the Instrument of Student Judicial Governance for policies and procedures pertaining to the honor system.

The UNC honor Code states: "It shall be the responsibility of every student at The University of North Carolina at Chapel Hill to obey and to support the enforcement of the honor code, which prohibits lying, cheating, or stealing when these actions involve academic processes or University, student or academic personnel acting in an official capacity."

To meet this standard in this course, note the following: in written work, all ideas (as well as data or other information) that are not your own must be cited (including unpublished work). Discussion of assignments with peers outside your groups is strongly encouraged, but your work must be your own. We are committed to treating Honor Code violations seriously and urge all students to become familiar with its terms set out at https://studentconduct.unc.edu/. If you have questions, it is your responsibility to ask the professor about the Code's application. Please consult with the instructor if you are uncertain about your responsibilities under that code with respect to this course.

**Resources.** Our purpose as professors is to help you to excel in this learning environment. Should you need further assistance beyond the help of the professor, please consult the following on-campus resources:

- The Writing Center: http://writingcenter.unc.edu
- The Learning Center: http://learningcenter.unc.edu
- The Learning Center resources for students with learning disabilities (LD) and/or attention-deficit/hyperactivity disorder (ADHD): https://learningcenter.unc.edu/services/ldadhd-services/
- Counseling and Psychological Services (CAPS; https://caps.unc.edu/) is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services.
- Campus health services: http://campushealth.unc.edu

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities. Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at https://eoc.unc.edu/report-an-incident/. Please contact the University's Title IX Coordinator (titleixcoordinator@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at https://safe.unc.edu/.

## Course outline

For each course topic, required readings are provided. A special effort has been made to select relevant, timely and well-written readings. Additional resources are listed that can be examined in detail, depending upon your interest in the subject. The source and style of each reading varies considerably. I recommend downloading all of the materials as they may serve you as useful references during future classes or in your career.

*** Reading comprehension and time management are skills. PLEASE READ ASSIGNED MATERIAL BEFORE EACH CLASS***

*The professor reserves to right to make changes to the syllabus, including assignment due dates, when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.*

****Please arrive on time and turn off cell phones in class****

**GIS Assignment ("Assignment 0"):** On your own, please complete the Linked-In Learning virtual course, "Learning QGIS" (Gordon Luckett; October 2019) at https://software.sites.unc.edu/linkedin/. This course augments the GIS sessions of PLAN 590 and PLAN 745 and consists of 12 modules scheduled to take approximately 3 hours. Upon completion, you will receive a PDF certificate that you can submit via Canvas Assignments (due: Sept 20th).

If you have already completed this certificate, then please submit it; you are not required to re-do it (although it may help to refresh).

Additionally, if you have not had previous GIS training, please enroll in the Linked-In Learning course "ArcGIS Pro Essential Training," (July 2023) which consists of 10 modules scheduled to take approximately 3.5 hours. If you need even more basic training – you have never been exposed to GIS at all – you should also complete the "Foundations of Geographic Information Systems (GIS)" (November 2021) course (1 hour).

**January 10, 17: *Course overview, impact assessment history, uses, and key choices***

**Textbook**: Chapter 4 (Institutions of Infrastructure: The Providers) and Chapter 8 (Developing the Public Infrastructure Project)

Mary M. Edwards. 2000. Chapter 1, Introduction and Chapter 6, Putting It All Together, in *Community Guide to Development Impact Analysis*, Madison, WI: Wisconsin Land Use Program, University of Wisconsin-Madison, March 2000, pgs. 3-7 and 73-76.

Edward J. Kaiser, David R. Godschalk, and F. Stuart Chapin, Jr. 1995. Development Proposal Evaluation, in *Urban Land Use Planning*, Fourth Edition, Urbana, IL: University of Illinois Press, pgs. 438-453.

Carissa S. Slotterback. 2011. Evaluating the Implementation of Environmental Review Mitigation in Local Planning and Development Processes. *Environmental Impact Assessment Review 28*(8): 546-561.

David P. Lawrence. 2007. Impact Significance Determination – Back to basics. *Environmental Impact Assessment Review*, 27: 755–769.

Additional resources providing an overview of development impact assessment:

- For those new to planning and in need of an overview of planning and infrastructure relationships: **Textbook**: Chapter 3 (Growth, Demand, and the Need for Infrastructure) and Chapter 5 (Local Plans and Infrastructure)
- **Textbook**: Chapter 7 (Smart and Sustainable Development Rules) and Chapter 14 (Exactions and Impact fees)
- Richard K. Morgan. 2012. Environmental impact assessment: the state of the art. *Impact Assessment and Project Appraisal*, 30(1): 5-14.
- Leonard Ortolano. 1997. Chapter 16: Forecasting Environmental Effects of Proposed Projects and Regulatory Actions, *Environmental Regulation and Impact Assessment*, New York: John Wiley and Sons, Inc., pgs. 347-373.
- Developer perspectives: Robert W. Burchell. 1994. Chapter 2: Legal and Administrative Considerations, in *Development Impact Assessment Handbook*, Washington, DC: ULI-the Urban Land Institute, pgs. 16-25.
- Zhao Ma, Dennis R. Becker, and Michael A. Kilgore. 2009. Characterising the landscape of state environmental review policies and procedures in the United States: a national assessment. *Journal of Environmental Planning and Management* 52(8): 1035–1051.
- Robert W. Burchell. 1993. Environmental Setting, in *Development Impact Assessment Handbook*, Washington, DC: Urban Land Institute. Pgs. 38-41.
- Robert D. Sculley. 1998. *A Basic Strategy for EIR Preparation*, San Francisco, CA: Tetra Tech, Inc.
- Bruce Hendler. 1977. *Caring for the Land*, Planning Advisory Service Report No. 328. Chicago: American Planning Association, pgs. 5-65.
- R.K. Jain, et. al. Introduction. *Environmental Assessment, 2nd Edition*. New York: McGraw-Hill, 2002, pgs. 1-12

- William Fulton. 2013. 60% of EIR Challenges Involve Infill Projects. California Planning & Development Report [Also online]. Available: http://www.cp-dr.com/articles/node-3310

Additional resources on specific aspects of development impact assessment:

- *California Environmental Quality Act (CEQA) model*: Robert Olshansky. 1996. The California Environmental Quality Act and Local Planning. *Journal of the American Planning Association*. 62(3): 313-330.
- *North Carolina State Environmental Policy Act (SEPA):* N.C. Department of Administration. 1999. Environmental Assessment Guidelines. pgs. 1-7.
- Tim Snell and Richard Cowell. 2006. Scoping in environmental impact assessment: Balancing precaution and efficiency? *Environmental Impact Assessment Review* 26(4): 359-376.
- Thomas D. Boston. 2005. The Effects of Revitalization on Public Housing Residents: A Case Study of the Atlanta Housing Authority. *Journal of the American Planning Association 71(4)* 393-407.

Examples of environmental assessments on Canvas:

- *World Trade Center*: Lower Manhattan Development Corporation. 2004. The World Trade Center Memorial and Redevelopment Plan Final Generic Environmental Impact Statement. [Online]. http://www.renewnyc.com/PlanDesDev/environmental_impact_contents_april2004.asp
- *Domestic Example*: City of Lakewood, CA. 2007. Master Environmental Assessment (MEA) for the City of Lakewood Comprehensive General Plan.
- *International Example*: Dublin Docklands Development Authority. 2003. Dublin Docklands Area: Strategic Environmental Assessment of the Draft Master Plan.
- *International Example*: Trump International Golf Links Scotland, Ltd. 2008. Aberdeenshire Council Planning Authority under Town and Country Planning (Scotland) Act of 1997.

**Jan 15: *MARTIN LUTHER KING, JR. DAY – NO CLASS***

**Jan 22, 24: *Fiscal impact assessment***

Zenia Kotval and John Mullin. 2006. *Fiscal Impact Analysis: Methods, Cases, and Intellectual Debate*. Cambridge, MA: Lincoln Institute of Land Policy.

Additional resources:

- **Textbook**: Chapters 9-15 [comprehensive overview of infrastructure financing]
- Lamie, R. David, Wallace Campbell, and William Molnar. 2012. The Fiscal-Geographic Nexus: An Overview of Fiscal Impact Assessment in Local Policy Development. *Applied Geography* 32(1): 54–60.
- Leistritz, F. Larry. 1994. Economic and Fiscal Impact Assessment. *Impact Assessment* 12(3): 305–317.
- Example from Chatham Park development project: Vicus Development Group. 2017. North Village fiscal impact analysis (Chatham Park). Chatham Park Investors, LLC: Pittsboro, North Carolina.
- See zipped file listing several "foundational readings" on fiscal impact assessment on Canvas

**Jan 29, 31, Feb 5: *Transportation impact assessment*** (*Guest Lecture: Session 3 – Bergen Watterson, Transportation Planning Manager, and Sarah Poulton, Downtown Special Projects Manager, Town of Chapel Hill*)

*Class Session 1*:

**Textbook**: Chapter 20 (Streets and Streetscapes) and Chapter 21 (Automobiles and Mass Transit)

Michael McNally. 2007. The four-step model, in *Handbook of transport modelling*, pgs. 35-41.

*Class Session 2*:

Institute of Transportation Engineers. 2006. Transportation Impact Analyses for Site Development (Student Supplement).

Papacostas, P. and P. Prevedouros. 2001. Chapter 9: Traffic Impact and Parking Studies (Pgs 456-497). *Transportation Engineering and Planning, 3rd edition*. Upper Saddle River, NJ: Prentice-Hall, Inc.

*Class Session 3-4*:

Morten Skou Nicolaisen, and Patrick Arthur Driscoll. 2014. Ex-post evaluations of demand forecast accuracy: A literature review. *Transport Reviews* 34(4): 540-557.

U.S. Department of Transportation, Federal Highway Administration. 2007. Chapter 4C. Traffic Control Needs Studies. *Manual on Uniform Traffic Control Devices*, 2003 Edition with Revisions 1 and 2, December 2007.

Additional resources

- *Examples of Traffic Impact Assessment Requirements*: Chapel Hill, NC, Montgomery County, MD, County of Barnstable, MA, and the Maryland-National Capital Park and Planning Commission.

- *Numerous Examples of Traffic Impact Assessment Reports are located on Canvas*.
- Reid Ewing and Robert Cervero. 2001. Travel and the Built Environment: A Synthesis. *Transportation Research Record*, 1780: 87-114.
- Randall Crane. 1996. Cars and Drivers in the New Suburbs: Linking Access to Travel in Neotraditional Planning. *Journal of the American Planning Association* 62(1): 51-65.

**Feb 12: *WELL-BEING DAY – NO CLASS***

**Feb 7, 14: *Climate change impacts and lifecycle assessment*** *(Guest Lecture: Session 2 – Prof Noah Kittner, UNC DCRP and Environmental Science and Engineering)*

*Overview*: **Textbook**: Chapter 27 (Energy and Power)

Padgett, J. P., Steinemann, A. C., Clarke, J. H., & Vandenbergh, M. P. 2008. A comparison of carbon calculators. *Environmental impact assessment review* 28(2): 106-115.

Carissa S. Slotterback. 2011. Addressing climate change in state and local environmental impact analysis. *Journal of Environmental Planning and Management* 54(6): 749-767.

Additional resources on general climate impact analysis issues:

- Reid Ewing, et. al. 2007. Overview, pgs. 1-16 in *Growing Cooler: The Evidence on Urban Development and Climate Change*. Washington, DC: Urban Land Institute, 2007.
- Elizabeth Wilson and Jake Piper. 2010 Chapter 2: Climate Change Mitigation and Adaptation: Impacts and Opportunities, pgs. 18-43 in *Spatial Planning and Climate Change*. Routledge.
- Harriet Bulkeley. 2013. Chapter 3: Accounting for urban GHG emissions, pgs. 45-70 in *Cities and Climate Change*. Routledge.
- University of Hamburg. 2012. *Why Weather isn't the same as Climate: Ten Climate Researchers Report*. University of Hamburg: Hamburg, Germany.
- Nejadkoorki, F., Nicholson, K., Lake, I. and Davies, T., 2008. An approach for modelling $CO_2$ emissions from road traffic in urban areas. *Science of the Total Environment*, 406(1): 269-278.
- Henry D. Jacoby. 2013. *Implications of Climate Science for Policy (Climate Policy Note # 2).* MIT Joint Program on the Science and Policy of Global Change: Cambridge, MA.
- Patrick Condon. 2008. Planning for Climate Change. *Land Lines (Lincoln institute of Land Policy),* January Pgs. 2-7.

Additional resources on lifecycle assessment:

- Charlene Bayer, Michael Gamble, Russell Gentry, and Surabhi Joshi. 2010. *AIA Guide to Building Life Cycle Assessment in Practice*. American Institute of Architects: New York, NY.
- Bilec, M.M., Ries, R.J. and Matthews, H.S., 2009. Life-cycle assessment modeling of construction processes for buildings. *Journal of infrastructure systems*, 16(3): 199-205.

**Feb 19, 21, 26: *GIS*** *(Guest Lectures: Sessions 1-2 – Philip McDaniel, UNC GIS Librarian)*

Jonathan Campbell and Michael Shin. 2011. Essentials of Geographic Information Systems. Minneapolis, MN: Center for Open Education. [Online] Available: https://open.umn.edu/opentextbooks/textbooks/essentials-of-geographic-information-systems. See Chapters 1, 3-7.

Additional resources

- QuantumGIS (QGIS) Tutorials: [Online]: http://www.qgistutorials.com/en/docs/introduction.html
  - This is a tutorial created for QGIS, a free and open-source alternative to ESRI's ArcGIS hegemony. Great worksheets and information on GIS concepts
- Harvard Map Collection. 2020. GIS Tutorials and Exercises: Introduction to Geographic Information Systems (GIS) Tutorial. Harvard University: Cambridge, MA. [Online]: https://gis.harvard.edu/tutorials (QGIS tutorial is at: https://gis.harvard.edu/qgis-workshop-and-video-tutorials-0)

Additional resources

- Juliana Maantay and John Ziegler. 2006. Map projections and coordinate systems, Chapter 2 – Spatial Data and Basic Mapping Concepts, pgs. 39-53 and Chapter 6 – Sources of Urban Data, pgs. 157-177 in *GIS for the Urban Environment*. Redlands, CA: ESRI Press.
- Agustin Rodriguez-Bachiller with John Glasson. 2004. GIS and Impact Assessment (Chapter 3), pgs. 52-80 in *Expert Systems and Geographic Information Systems for Impact Assessment*. London: Taylor and Francis.
- Robert B. Kent and Richard E. Klosterman. 2000. GIS and Mapping: Pitfalls for Planners. *Journal of the American Planning Association* 66(20): 189-198

- Another good overview of basic GIS material: Kang-tsung Chang. 2002. Chapter 1 – Introduction, pgs. 1-10, Chapter 3 – Vector Data Model, pgs. 31-49, and Chapter 6 – Attribute Data Input and Management, pgs. 100-113, in *Introduction to Geographic Information Systems*, Boston: McGraw-Hill.

**Feb 28: *Health impact assessment***

Anna Ricklin, Michelle Madeley, Elizabeth Whitton, and Angelica Carey. 2016. *The State of Health Impact Assessment in* Planning. Chicago, IL: American Planning Association.

Lhachimi, S. K., Nusselder, W. J., Boshuizen, H. C., & Mackenbach, J. P. 2010. Standard tool for quantification in health impact assessment: a review. *American Journal of Preventive Medicine* 38(1), 78-84.

Additional resources

- Human Impact Partners. 2011. *A Health Impact Assessment Toolkit: A Handbook to Conducting HIA, 3rd Edition*. Oakland, CA: Human Impact Partners.
- American Planning Association. 2017. Healthy Communities Policy Guide. American planning Association: Chicago, IL.
- Hebert, Katherine A., Arthur M. Wendel, Sarah K. Kennedy, and Andrew L. Dannenberg. 2012. Health impact assessment: a comparison of 45 local, national, and international guidelines." *Environmental Impact Assessment Review* 34: 74-82.
- Ross, C.L., de Nie, K.L., Dannenberg, A.L., Beck, L.F., Marcus, M.J. and Barringer, J., 2012. Health impact assessment of the Atlanta BeltLine. *American Journal of Preventive Medicine* 42(3), 203-213.
- The Health Impact Project: https://www.pewtrusts.org/en/research-and-analysis/data-visualizations/2015/hia-map
- UCLA HIA Clearinghouse: https://www.ph.ucla.edu/hs/health-impact/index.htm

**Mar 4, 6: *Public service impact assessment***

**Textbook**: Chapter 25 (Public Schools as Public Infrastructure) and 21 (Parks, Recreation, and Open Space)

Additional resources (emergency services)

- Shaham, Yonatan and Itzhak Benenson. 2016. Modeling Urban Fires in Mediterranean and Middle- Eastern Cities. IEE Conference Paper.
- Larry W. Canter, Samuel F. Atkinson, and F. Larry Leistritz. 1985. Police and Fire Protection (Pgs. 104-117) in *Impact of Growth: A Guide for Socio-Economic Impact Assessment and Planning*, Chelsea, MI: Lewis Publishers, Inc.
- Mary M. Edwards. 2000. Worksheet 4.4: Public Safety, in *Community Guide to Development Impact Analysis*, Madison, WI: Wisconsin Land Use Program, University of Wisconsin-Madison, pg. 103 (A19).

Additional resources (schools)

- Larry W. Canter. 1995. Chapter 14 – Prediction and Assessment of Impacts on the Socioeconomic Environment (*Education Services Impacts* section, pgs. 519-525) in *Environmental Impact Assessment, 2nd Edition*. New York: McGraw-Hill.
- Mary M. Edwards. 2000. Worksheet 4.5: Education and Libraries, in *Community Guide to Development Impact Analysis*, Madison, WI: Wisconsin Land Use Program, University of Wisconsin-Madison, March 2000, pgs. 104 (A20).
- *Example School Analysis:* Wittman, Art. 2002. Student Generation Multiplier Study. School Board of Palm Beach County, FL.

Additional resources (parks and recreation)

- Sue Enger. 1994. Parks/Open Space/Recreation Facilities Standards, pgs. 21-37 in *Level of Service Standards - Measures for Maintaining the Quality of Community Life*. Report No. 31, Municipal Research and Services Center of Washington.
- James D Mertes and James R. Hall. 1995. Section 3: Level of Service Guideline for System Planning, Pgs 57-92 in *Park, Recreation, Open Space, and Greenway Guidelines,* National Recreation and Park Association: Lubbock, TX.
- Peter Hartik. 2008. Creating and Maintaining Parks: Funding and Other Means, pgs 75-88 in *From Recreation to Re-creation (PAS 551): New Directions in Parks and Open Space System Planning. Planners Press: Chicago, IL.*

**Mar 11, 13: *SPRING BREAK – NO CLASS***

**Mar 18, 20, 25: *Water supply impact assessment*** *(Guest Lecture: Session 2 – Planning and Infrastructure at OWASA*, Vishnu Gangadharan, OWASA Director of Engineering and Planning*)*

*Class Session 1*

**Textbook**: Chapter 16 (Water Supply)

*Class Sessions 2 + 3*

Jerry A. Nathanson. 2002. Chapter 2: Hydraulics, pgs. 27-41; and Chapter 7: Water Distribution Systems, pp 181-184, 200-211 in *Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control*. 4th ed., Englewood Cliffs, NJ: Prentice Hall.

Tony Nye and Karen Mancl. 2001. *Fact Sheet: Water Sources for Fire Protection in Small Communities*. Columbus, OH: The Ohio State University Extension.

Additional graywater/water re-use resources

- National Academies of Science. 2016. *Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits*. National Academies Press, Washington, D.C.
- J. Price, Fielding, K.S., Gardner, J., Leviston, Z. and Green, M., 2015. Developing effective messages about potable recycled water: The importance of message structure and content. *Water Resources Research*, 51(4): 2174-2187.

Additional infrastructure financing resources

- Ronald F. Cilensek. 2005. Water Treatment Plant Construction Cost Estimating, Ch. 26 in: American Water Works Association. *Water Treatment Plant Design, 4th edition*. New York: McGraw-Hill Professional.
- Tanellari, E., Bosch, D., Boyle, K. and Mykerezi, E., 2015. On consumers' attitudes and willingness to pay for improved drinking water quality and infrastructure. *Water Resources Research*, 51(1):47-57.

Additional infrastructure planning resources

- Ward, F.A. and Pulido-Velazquez, M., 2008. Water conservation in irrigation can increase water use. *Proceedings of the National Academy of Sciences*, 105(47): 18215-18220.
- Ross & Associates Environmental Consulting, Ltd. 2012. *Planning for Sustainability: A Handbook for Water and Wastewater Utilities (EPA-832-R-12-001)*. US Environmental Protection Agency: Washington, D.C.

**Mar 27: *Field trip to OWASA water treatment plant***

**Apr 1: *Wastewater impact assessment***

*Overview*: **Textbook**: Chapter 17 (Wastewater and New Paradigms)

Jerry A. Nathanson. Chapter 2: Hydraulics, pgs. 41-44; and Chapter 8: Sanitary Sewerage Systems, pp 217-231 in *Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control*. 4th ed., Englewood Cliffs, NJ: Prentice Hall, 2002.

Additional resources

- Ronald F. Cilensek. 2005. Water Treatment Plant Construction Cost Estimating, Ch. 26 in: American Water Works Association. *Water Treatment Plant Design, 4th edition*. New York: McGraw-Hill Professional.

**Apr 3: *Field trip to OWASA wastewater treatment plant***

**Apr 8: *CLASS CANCELED***

**Apr 10: *Habitat destruction, fragmentation, and offset assessment***

Sharon K. Collinge. 1996. Ecological consequences of habitat fragmentation: implications for landscape architecture and planning. *Landscape and Urban Planning* 36: 59-77.

Pavel Kindlmann and Francoise Burel. 2008. Connectivity measures: a review. *Landscape Ecology* 23:879–890

Additional resources

- BenDor, T.K. and Woodruff, S., 2014. Moving targets and biodiversity offsets for endangered species habitat: is lesser prairie chicken habitat a stock or flow? *Sustainability*, 6(3): 1250-1259.
- Boitani, L., Falcucci, A., Maiorano, L., & Rondinini, C. (2007). Ecological networks as conceptual frameworks or operational tools in conservation. *Conservation Biology* 21(6): 1414-1422.
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**Apr 15, 17, 22: *Stormwater impact assessment***

*Class Sessions 1-2 (stormwater quantity/hydrology):*

*Overview*: **Textbook**: Chapter 18 (Stormwater and Flooding)

Jerry A. Nathanson. Chapter 9: Stormwater Management, pgs. 251-269 in *Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control*. 4th ed., Englewood Cliffs, NJ: Prentice Hall, 2002.

Natural Resource Conservation Service (NRCS). 1986. Urban Hydrology for Small Watersheds (Second Edition). Washington, D.C.: U.S. Department of Agriculture.

*Class Session 3 (stormwater quality):*

Jerry A. Nathanson. Chapter 9: Stormwater Management, pgs. 269-273 in *Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control*. 4th ed., Englewood Cliffs, NJ: Prentice Hall, 2002.

John Randolph, Chapter 13, Land Use, Stream Flow, and Runoff Pollution, pgs. 392-406; 434-466 in *Environmental Land Use Planning and Management,* Washington, DC: Island Press, 2004.

Additional resources

- North Carolina Department of Natural Resources. Selecting the Right BMP, pgs. 4-1 -7 in *Stormwater Best Management Practices Manual*, July 2007.

**Apr 24, 29: *Wetland and stream impact assessment, mitigation, and policy***

Fennessy, M. Siobhan, Amy D. Jacobs, and Mary E. Kentula. 2004. Review of rapid methods for assessing wetland condition (EPA/620/R-04/009). US Environmental Protection Agency: Washington, DC.

**Textbook**: Chapter 29 (A New Paradigm for Infrastructure)

Additional resources

- M. Acreman & J. Holden. 2013. How wetlands affect floods. *Wetlands* 33:773–786.
- NC Wetland Assessment Method (NCWAM). User Manual and Appendices: https://www.deq.nc.gov/about/divisions/water-resources/data-resources/ncwam-manual (skim)
- USEPA. 2013. Wetlands Supplement: Incorporating Wetlands into Watershed Planning. US Environmental Protection Agency (Region 5): Chicago, IL. Focus on Pgs. 1-40
- Sutula, Martha A., Eric D. Stein, Joshua N. Collins, A. Elizabeth Fetscher, and Ross Clark. 2006. A practical guide for the development of a wetland assessment method: the California experience. *JAWRA Journal of the American Water Resources Association* 42(1): 157-175.
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Additional resources (policy-focused):

- Palmer Hough and Morgan Robertson 2009. Mitigation under Section 404 of the Clean Water Act: where it comes from, what it means. *Wetlands Ecology and Management* 17(1):15-33.
- Greg Snowden and Vincent Messerly. 2014. Mimicking Natural Wetlands: A Recipe for Success at a Northeast Ohio Mitigation Bank. *National Wetland Newsletter*, 36(3):5-9.
- Todd BenDor and Martin Doyle. 2010. Planning for Ecosystem Service Markets. *Journal of the American Planning Association* 76: 59-72.