GEOGRAPHY 446: Water Resources Management

Dr. Christopher Woltemade

Fall 2010

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OFFICE HOURS:	Tuesday	8:30 – 9:30 AM
	Wednesday	1:00 – 4:00 PM
	Thursday	8:30 – 9:30 AM (or by appointment)

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GOALS: The goals of Geography 446 are to provide an understanding and appreciation of water resources management policies and institutions. A unifying theme of the course is the applicability of the concept of unified river basin management for water and related land resources in pursuit of diverse public objectives. The course stresses interrelationships among watershed planning, relevant legislation, agency authority and coordination, and the geography of watershed management. The course focus is on U.S. water resources policy issues and institutions. The course also emphasizes linkages between environmental sciences and management/planning institutions, including such topics as aquatic ecology, wetlands, floodplain management, recreation, water supply, hydropower, industry, and commercial shipping.

PREREQUISITE: Geo 226 Hydrology or consent of instructor.

TEXT: Dzurik. 2003. *Water Resources Planning,* 3rd ed. Rowman and Littlefield. This text is optional. Additional readings as assigned (see below).

ATTENDANCE: Attendance and participation in class are required. If you miss class, you are responsible for missed material and/or assignments. I am understanding of reasonable absences--see me and I will help you get back up to date. Students with more than two (unexcused) absences may receive a lower grade for the course, regardless of their performance, at the instructor's discretion. Disturbance of class—including any distraction from cell phones—will not be tolerated and may result in expulsion from the course and/or an "F" final grade, regardless of performance, at the instructor's discretion.

MAKE-UP EXAMS: If classes are cancelled on an exam day, the exam will be given the first class meeting when classes resume. Students are expected to take exams at the scheduled time. Only very unusual circumstances (e.g. family emergency, serious illness) are acceptable reasons for missing an exam. You MUST notify me prior to the exam date if you will miss an exam, IN ANY EVENT. Failure to notify me prior to a missed exam will result in a zero for that exam grade. Make up exams will differ from the original.

GRADING: Grades will be based on a minimum of 90% (A), 80% (B), 70% (C), 60% (D). Plus/minus grades may be given to scores ± 3% from these values.

Undergraduate students		Graduate students	
100 points	Mid-term exam	100 points	Mid-term exam
100 points	Final exam	100 points	Final exam
150 points	Research project	150 points	Research project
		50 points	Presentation
350 points	TOTAL	400 points	TOTAL

HELP: The Learning Assistance Center (webspace.ship.edu/learning) provides professional aid for you to improve your studies. Of course, feel free to come to my office to ask questions about course matters as well.

NOTE: The instructor is willing to make reasonable accommodations for students with limitations due to disability, including learning disability. Please see me the **first week of class** to discuss any special needs you have. Also, any expected religious holiday absences must be provided to the professor in writing by **September 7.**

COURSE OUTLINE		
Date	**Topic / Case study**	**Preparatory reading**
Aug 31	Course introduction: Watershed functions	➢ Dzurik – Chapter 1
Sep 2	Review of hydrologic fundamentals	➢ Dzurik – Chapter 2
Sep 7	Water quality and watershed best management practices *Case study: Burd Run watershed*	➢ **WEB LINK** Woltemade, C. J. and A. Wood. 2002. Comprehensive riparian restoration along Burd Run. *Land and Water,* **46**(2): 27-32. ➢ Angier, J. T. and G. W. McCarty. 2008. Variations in base-flow nitrate flux in a first-order stream and riparian zone. *JAWRA* **44**(2): 367-380.
Sep 9	**Field Trip: Burd Run restoration (Normal class time)**	
Sep 14	Public water supply *Case study: Shippensburg Borough Authority* **** Research topic due***	➢ Roy, S. B., P. F. Ricci, K. V. Summers, C. Chung, and R. A. Goldstein. 2005. Evaluation of the sustainability of water withdrawals in the U.S., 1995-2025. *JAWRA,* **41**(5): 1091-1108.
Sep 16	**Field trip: Shippensburg public water system (Meet 1:00 – 4:00)**	
Sep 21	Public water supply and water rates	➢ March, H. and D. Sauri. 2010. The suburbanization of water scarcity in the Barcelona metropolitan region: Sociodemographic and urban changes influencing domestic water consumption. *The Professional Geographer* **62**(1): 32-45.
Sep 23	**Bibliographic searches (Meet at library)**	

COURSE OUTLINE (continued)		
Date	**Topic / Case study**	**Preparatory reading**
Sep 28	Historical perspective on federal water legislation	➢ Dzurik – Chapter 4
Sep 30	Federal legislation: Clean Water Act *Case study: Conodoguinet Creek*	➢ Dzurik – p.77 ➢ **WEB LINK** PA-DEP TMDL fact sheet ➢ **WEB LINK** Conodoguinet Creek TMDL General Info ➢ Gowda, P. H., B. J. Dalzell, and D. J. Mulla. 2007. Model based nitrate TMDLs for two agricultural watersheds of southeastern Minnesota. *JAWRA,* **43**(1): 254-263. ➢ Paulsen, K., J. Featherstone, and S. Greene. 2007. Conservation-induced wastewater flow reductions improve nitrogen removal: Evidence from New York City. *JAWRA* **43**(6): 1570-1582.
Oct 5	Federal legislation: Clean Water Act *Case study: Chesapeake Bay* **** Bibliography due***	
Oct 7	**MID-TERM EXAM**	
Oct 12	**FALL BREAK – NO CLASS**	
Oct 14	Federal legislation: NEPA *Case study: Two Forks Dam, CO*	➢ Kenney, D. S., R. A. Klein, and M. P. Clark. 2004. Use and effectiveness of municipal water restrictions during drought in Colorado. *JAWRA,* **40**(1): 77-87.
Oct 19	Federal legislation: ESA *Case study: Cedar River Watershed, WA*	
Oct 21	Water law: riparian rights *Case study: Sylvan Creek, WV*	➢ Dzurik: Chapter 3
Oct 26	Water law: prior appropriation *Case study: Native American water rights*	➢ **WEB LINK** Federal and tribal reserved water rights ➢ Johnson, G. S., B. A. Contor, and D. M. Cosgrove. 2008. Efficient and practical approaches to ground-water right transfers under the prior appropriation doctrine and the Snake River example. *JAWRA* **44**(1): 27-36. ➢ MacDonnell, L.J. 2009. Return to the river: Environmental flow policy in the United States and Canada. *JAWRA* **45**(5): 1087-1099.
Oct 28	Multi-state institutions *Case study: Susquehanna River Basin Commission*	
Nov 2	Multi-state institutions *Case study: Colorado River Compact*	➢ Garrick, D., K. Jacobs, and G. Garfin. 2008. Models, assumptions, and stakeholders: Planning for water supply variability in the Colorado River Basin. *JAWRA* **44**(2): 381-398.

COURSE OUTLINE (continued)		
Date	**Topic / Case study**	**Preparatory reading**
Nov 4	Multi-state institutions *Case study: Arkansas River Compact*	➢ Tabidian, M. A. and D. T. Pederson. 1995. Impact of irrigation wells on baseflow of the Big Blue River, Nebraska. *JAWRA,* **31**(2):.295-306.
Nov 9	State water legislation *Case study: Pennsylvania DEP*	➢ Dzurik – Chapter 5
Nov 11	**CAREER DAY**	
Nov 16	State water legislation *Case study: Florida and Everglades restoration*	
Nov 18	Local water legislation: Wellhead protection	➢ Dzurik – Chapter 11 ➢ **WEB LINK** Wellhead protection in Pennsylvania ➢ Kauffman, G. J. M. B. Corrozi, and K. J. Vonck. 2006. Imperviousness: A performance measure of a Delaware water resource protection area ordinance. *JAWRA,* **42**(3): 603-615.
Nov 23	Local water legislation: Stormwater management **** Research report due***	➢ Holman-Dodds, J. K., A. A. Bradley, and K. W. Potter. 2003. Evaluation of hydrologic benefits of infiltration based urban stormwater management. *JAWRA,* **39**(1): 205-215.
Nov 25	**THANKSGIVING BREAK – NO CLASS**	
Nov 30	Adaptive management / integrated water resources management *Case study: Rocky Reach Dam and Columbia River, WA*	➢ Dzurik – Chapters 6, 13; p.117-120 ➢ Allan, C., A. Curtis, G. Stankey, and B. Shindler. 2008. Adaptive management and watersheds: A social science perspective. *JAWRA,* **44**(1): 166-174. ➢ Gober, P., C.W. Kirkwood, R.C. Balling, A.W. Ellis, and S. Deitrick. 2010. Water planning under climatic uncertainty in Phoenix: Why we need a new paradigm. *Annals of the Association of American Geographers,* **100**(2): 356-372.
Dec 2	Integrated water resources management *Case study: Upper Mississippi River management*	➢ Dzurik – Chapters 8 - 10 ➢ Woltemade, C. J. 1997. Water level management opportunities for ecological benefit, Pool 5 Mississippi River. *JAWRA,* **33**(2): 443-454. ➢ **WEB LINK** Upper Mississippi River system overview
Dec 7	Integrated water resources management *Case study: watershed management in Nicaragua*	
Dec 9	**Research presentations**	
Dec 16	**FINAL EXAM – 1:00 pm**	

Research project options

Each student must complete a research project. All final written reports should be well organized, carefully written, and properly documented. Include a table of contents and use a hierarchy of headings and subheadings to organize the report (e.g. Introduction, Study Area, Methods, Results, Discussion, Conclusions, References). Maps, figures, tables, etc. are essential. You must include at least two original graphics that you prepare (e.g. Excel graphs, GIS maps, etc.) Proofreading and editing errors are unacceptable.

Research papers should address significant water resource issues within a watershed-based management framework. All papers must also address water management *institutions* relevant to the topic (e.g. laws, policies, comprehensive plans, agencies involved, etc.). Note that projects might vary considerably in terms of the emphasis of your work, including those that are based heavily on GIS, field work, planning tools, hydrologic analysis, cost-benefit economics, etc. Research papers must include a *minimum* of 10 refereed sources (15 for graduate students), and must be *less than* 15 pages double-space (20 pages for graduate students), not including abstract, references, figures, or tables. You are encouraged to visit your study area, collect and analyze your own data, conduct personal interviews, etc.

Key steps in the research process include:

- Identify the water management issue(s) you will address. There are many possibilities, including:
  - Non-point sources of pollution
  - Urban storm water management
  - Stream channel restoration
  - Treatment of acid mine drainage
  - Public water supply
  - Aquatic habitat quality
  - Fisheries management
  - Soil erosion and sedimentation
  - Flood control
  - Water-based recreation
  - Wetlands conservation
  - Critical aquifer recharge areas
  - Sustainable land use planning
- Identify a watershed of reasonable size as your study area. Any watershed scale is acceptable, but small watersheds often work best. Consider watersheds smaller than counties.
- Maintain a watershed-wide perspective.
- Conduct the literature review (see requirements of bibliography). Note that *in addition to the refereed literature,* previous studies on your selected watershed might be very useful, including:
  - Rivers Conservation Plans
  - Watershed Conservation Plans
  - Tributary Strategy Implementation Plans (under Chesapeake 2000 agreement)
  - Storm water management plans
  - Pennsylvania Act 167 plans
  - Pennsylvania Act 537 plans
  - Agency reports (e.g. SRBC, DRBC, Act 220 State Water Plan, etc.)

Research projects must include the following sections (you may use more descriptive headings):

Abstract	An abstract is a short (<250 words), complete summary of your research focus, methods, and results. It should not include references to cited works. See the supplemental readings (journal articles) for examples.
Introduction	Briefly summarize the purpose and scope of the study. State why and where the study was conducted. Explain why the problem to be addressed is important and the benefits of this study. Explain the overall organization of the report.
Purpose and scope	Explicitly define the research hypotheses / questions addressed by the study and limit the study in scope.
Literature review	Briefly describe existing literature identified as useful to your study. Previous research within or near the study area *and* work that is topically or methodologically similar should be included. Note that this must be presented as a well-organized, integrated narrative, not an annotated bibliography or bullet points.
Study area	Limit the geographic extent of the study and describe the relevant characteristics of that area (water resource utilization, hydrology, geology, soils, vegetation, land use, economy, political and legal concerns, institutional context, etc.).
Methods	Explain the techniques used to collect, analyze, and display data or information. Data are not included here, but methods (literature review, map analysis, mathematical work, etc.) should be described.
Results	Report the information (data) collected and the results of your analysis. You should address the research questions described previously.
Conclusions	Summarize the most important points, relating to previous studies (cited literature and providing a succinct summary statement related to the main purpose of the study.
References cited	Use JAWRA format.

Deadlines

Sept. 14	Topic approval due. Provide a 1-page (or less) description of a well-focused topic *that we have discussed and approved.*
Oct. 5	Bibliography due (50 points). Provide a listing of all references acquired, including books, journal articles, maps, personal contacts, internet sites, and other media. **A minimum of 10 (undergraduate) or 15 (graduate) refereed journal articles are required.** You should also include other several sources. The cited sources must be in hand or in route to you by Oct. 6. Use the *JAWRA* format for references cited.
Nov. 23	Written report due (100 points).
Dec. 9	Research presentations (50 points).

Graduate Student Projects

Graduate student research projects are expected to provide a thorough review of literature relevant to the identified topic. The literature review may constitute a substantial part (e.g. 25-50%) of the final report. In addition, all graduate student projects must provide some "added value" beyond a review of the literature. For example, you might collect and analyze your own data, analyze previously collected data in new and innovative ways, provide a new spatial analysis of a problem (perhaps using GIS), provide a meaningful update to previously conducted research, etc. *The point is that you must conduct some original work beyond repackaging the science already available in published works.* Feel free to discuss your ideas and this requirement with me.

Oral presentations

Each graduate student must present their results in class on December 9. Undergraduate students who would like to present their results should discuss this option with me. Presenters MUST use visual aids (e.g. PowerPoint) and may NOT read presentations. Copies of your abstract should be distributed to the entire class. Handouts in addition to the abstract are encouraged.

Make sure you present (1) a strong introduction which maps out the main points or topics and (2) a strong conclusion that re-emphasizes the most important ideas. Illustrate your work with graphics such as maps, diagrams, graphs, photos, etc.