UAPP 411/611: Regional Watershed Management
Syllabus for Spring Semester 2013

Texts & Resources

Catalog Description
This course is designed to review the practical applications of watershed planning and management as a tool to manage land, water, and ecosystem resources. Students will explore the public policies and practices of watershed management by examining case studies in water supply, water quality, drought, floodplain, and stormwater management in the Delaware River and Chesapeake Bay basins. The watershed curriculum will utilize a multi-disciplinary approach involving the fields of geography, environmental science, geology, public policy, environmental economics, urban and regional planning, geographic information systems (GIS), and civil/environmental engineering. 3 credits.

Course Objectives
This course will enable students to:
1. Define goals and objectives to address water resources problems.
2. Understand Federal, State, regional, and local policies as they apply to watershed management.
3. Delineate a watershed utilizing GIS mapping techniques.
4. Develop and implement a watershed management plan.
5. Examine the various engineering, institutional, governance, legal, and financial frameworks needed for successful implementation of a watershed management plan.

Grading
Final grades will be based on the following criteria:
Participation/quizzes, mid-term exam, final exam, mid-term project, final term paper
- Quizzes may be given.
- No make-up exams will be scheduled except due to hardship with the consent of the instructor.
- No project will be accepted for grading after its due date.

Class Schedule
Feb 6, 2013 - Introduction to Watershed Management. What is a watershed? Define watershed goals,
objectives, problems, and stakeholders

I. Introductions
- The Atlantic Sturgeon
- Hand out student information sheets
- Identify home on watershed maps

II. Review of Syllabus
- Texts/Resources
- Course Objectives
- Grading
- Class Schedule/Format
- Project Assignments

III. Introduction to Watershed Management
- What is a watershed?
- History of watershed management
- Watershed problems (water supply/quality/flooding, etc.)
- Goals/Objectives
- Stakeholders (governments/environmentalists/businesses)

Break

IV. The Delaware River

V. Homework


VI. Class Dismissed

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Feb 13, 2012 - Compiling a GIS watershed inventory: geology, soils, topography, land use, zoning, political boundaries, point and nonpoint source pollutants

I. Class Business
 Quiz No. 1
- Syllabus Feedback
- Watershed Team Selection
- Current Events Discussion

II. Discussion of Readings

III. GIS Watershed Inventory Laboratory/Technical Exercise/Discussion
- Delineate a watershed by hand using contour map
- Aerial photo interpretation of land use/soils mapping
- How to build a watershed using ARCVIEW (Christina Basin)
- State boundaries, municipalities
- Hydrology/watersheds

Break

IV. Watersheds: Connecting Weather to the Environment, University Corporation for Atmospheric Research http://www.meted.ucar.edu/broadcastmet/watershed/
V. USEPA Top 10 Watershed Lessons Learned
VI. Video – Storm on Tap Weather Channel
VII. Homework
VIII. Class Dismissed
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Feb 20 Watershed management using GIS
I. Class Business
• Finalize Field Recon. Schedule
• Discuss mid-term Class Project No. 1
II. GIS and Powerpoint Basics for Watershed Management
III. Introduction to Watershed Management, National Academy of Sciences
IV. Spatial and Temporal Scales of Watersheds
V. Homework
VI. Class Dismissed
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Feb 27 - Federal and state watershed policies, programs, and regulations. Local, municipal, and county watershed programs and ordinances
I. Class Business
* Review of Watershed Project No.1 Teams
* Field Recon of Christina Basin
II. Watershed GIS Laboratory
• GIS Delineation of Watershed – Upper Christina watershed
• GIS as a Watershed Tool
• GIS Watershed mapping using GOOGLE EARTH
III. The Federal, State, Local Political Structure and Watershed Civics
IV. Assigned Reading
Watershed Management Plan. 
Tenth Report to the Governor and General Assembly Regarding the Progress of the Delaware Water 
V. Class dismissed 
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Mar 6 Water supply, water quality, and drought management issues and problems. Floodplain, 
stormwater, habitat, land use, and riparian corridor issues and problems 
I. Class Business 
* Quiz 
* Review of March 20, 2013 field reconnaissance 2:00 - 5:30 pm, Christina Basin by bus/van 
II. Federal Watershed Regulations and Programs 
• Safe Drinking Water Act 
• Clean Water Act (Section 404/305b, TMDL) 
• Delaware Estuary Program 
• Wild and Scenic Program 
III. State Watershed Regulations and Programs 
• DE Whole Basin 
• Section 319 
• Inland Bays 
• DE Stormwater and Sediment Control Regulations 
IV. Design of Watershed Restoration BMPs 
• Floodplain, Stormwater, Habitat, Land Use, Riparian Issues 
• Point and Nonpoint Source BMP Solutions, Structural/Nonstructural 
• Water Quality Models 
VI. Water Supply Issues and Alternatives 
• Water Supply, Water Quality, Drought Issues 
• Storage, Groundwater, Pipeline, Technology Alternatives 
V. Homework 
Purdue University.  Local Government Assistance Network. Land Use Impacts on Water Quality. 
www.ecn.purdue.edu/runoff/lthianew. 
Strategy (WRAS) for the Delaware Portion of the Christina Basin. pp. 1 - 77. 
Prepare One Page Watershed Plan (Title, Mission Statement, Problems Statement, Goals/Objectives) 
VII. Class dismissed 
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Mar 13 - Development of a draft watershed management plan 
I. Introduction 
• Quiz 
• Review of Christina Basin Field Trip 
• Review for mid term exam 
• Review of watershed (computer vs. student) digitizing exercise
II. Development of a Watershed Management Plan
- Title
- Mission Statement
- Problems/Issues
- Goals/Objectives
- Regulations/Ordinances
- GIS Watershed Inventory
- Alternatives Analysis
- Conclusions/Recommendations

Break

III. Watershed Planning Processes

IV. Homework Assignment
* Watershed teams continue Project No. 1 for presentation, due April 4, 2012
- Watershed team conduct stream habitat monitoring, due April 4, 2012
- Read for class April 21, 2012:
  Feature article from Watershed Protection Techniques. 2(2): 329-337

V. Class dismissed

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Mar 20 - Field Reconnaissance to Watershed Projects in the Christina River Basin
Field Trip to Christina River Basin, An Urban and Rural Watershed Reconnaissance
I. Van leaves from front of UDWRA, DGS Annex  2:00
II. Wilmington Riverfront
III. Hoopes Reservoir
IV. Woodlawn Trustees/Brandywine Creek State Park
V. Wyeth Property Stream Restoration
VI. Pike Creek Stream Restoration Project
VII. Back to UDWRA  5:30 pm
Reminder to continue work on in class presentations.

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Mar 27 - Spring Break

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Apr 3 - Verbal presentation to class. Take home mid-term examination
I. Each watershed team delivers watershed management plan presentation to class (45 minutes each).
II. Take home mid-term exam due Week 10
III. Homework

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Apr 10 - Watershed governance and institutional issues. Watershed funding strategies.
I. Class Business
- Quiz
- Self appraisal on watershed presentations
- Mid-term exam due
II. Watershed Governance and Institutional Options
• Government Agencies
• Councils/Committees
• Water Districts
• Nonprofit Watershed Organizations and Associations

III. Watershed Funding Strategies
• Federal/State Grants and Loans
• Polluter Pays
• Capital Programs
• Fees/Taxes/Utilities

IV. Think, Pair, and Share Activity Governance/Funding
• Break up into paired groups and select a watershed
• Devise a governance and funding strategy
• Share with class using one page of notes

V. Homework
Kauffman, G. J., 2002. What if... the United States of America were based on Watersheds? Water Policy Journal. 4:57 - 68.

VI. Class dismissed

Apr 17 - Water Law, Watershed Economic Analysis, Environmental indicators, Watershed Education.

I. Class Business
• Quiz
• Upcoming Field Trip

II. Water Law and Ethics
• Environmental Ethics
• Eastern Riparian Rights
• Western Prior Appropriation

III. Watershed Economic Analysis
• Supply and Demand
• Discounting
• Benefit/Cost Analysis

IV. Watershed and Environmental Indicators
• Impervious Cover
• Water Quality
• Report Cards
• Habitat

V. Watershed Education

VI. Homework
Develop one page environmental indicators for selected watershed
VI. Class dismissed

Apr 24 - Case Studies in Interstate, State, and Local Watershed Management
1. Class Business
   * Term paper requirements
   * Review of Environmental Indicator Homework
II. Case Studies in Interstate Watershed Management
   • Delaware River Basin
   • Susquehanna River Basin
III Case Studies in State-wide Watershed Management
   • Broadkill River Tributary Action Team
   • Delaware Watershed Assessment Branch
IV. Nonprofit Local Watershed Management
   • Brandywine Valley Association
   • Chesapeake Bay Program
V. Local Watershed TMDLs
   • Appoquinimink River Watershed
   • Inland Bays Watershed
VI. Homework
Harris, H. J., and D. Scheberle, Ode to the Miners' Canary: The Search for Environmental Indicators. 177 - 200.

May 1 – Watershed Funding
Water Law


EPA Funding Guidebook

GWP Handbook of River Basins

DRBC Compact
May 8 - Last day of class. Review of semester, final exam, and term paper requirements.

SEMESTER REVIEW
1. Concepts of Watershed Management
2. Watershed Delineation
   * By hand
   * By ArcView GIS
3. Watershed Plan Format
   * Title
   * Mission Statement
   * Goals/Objectives
   * Applicable Ordinances/Regulations
   * Problem Statement
   * GIS Watershed Inventory
   * Alternatives/Analysis
   * Watershed Governance
   * Funding Strategies
   * Conclusions/Recommendations
4. Governance Entities
   * Agencies
   * Councils/Committees
   * Water Districts
   * Watershed Organizations/Associations
5. Watershed Funding Strategies
   * Federal/State Grants and Loans
   * Polluter Pays
   * Capital Programs
   * Fees/Taxes/Utilities
6. Water Law, Ethics, and Economics
7. Watershed Case Studies
   * Delaware River Basin Commission
   * Susquehanna River Basin Commission
   * Christina Basin TMDL Strategy
   * Broadkill Tributary Action Team
   * DE Source Water Protection
   * Brandywine Valley Association
   * Chesapeake Bay Program
   * Appoquinimink Watershed TMDL
   * Inland Bays watershed TMDL
8. Christina Basin Watershed Tour
9. Brandywine Creek Field Recon

Homework
Delaware River Basin Commission, Cornell University, Pennsylvania State University, Rutgers University, University of Delaware, Partnership for the Delaware Estuary, July 4, 2008. Technical
May 15 – Reading Day - Field Reconnaissance along Brandywine Creek via kayak

May 22 - Final Exam in classroom

Class Format
Learning about watersheds is an active process where students participate in class discussions and hands-on exercises. We will be meeting in a classroom with projection equipment. We will be utilizing this equipment for course presentations and demonstration of computer GIS methods. Some of the course involves field trips and discussions of case studies to explore actual applications of watershed management. You are highly encouraged to ask questions regarding any topic on watershed management. Class participation and attendance for the quizzes is strongly recommended as it counts for 20% of your grade. The course work will be rigorous but completion of the course will properly prepare you for a possible career in watershed management. The recommended class size is 30 students.

Project Assignments
Everyone will be assigned to watershed project teams of 4 – 5 students this semester. These groups will function independently during class and outside of class.

Mid Term Project - Development of a Watershed Plan
Each group will prepare a draft, preliminary watershed plan for a real or hypothetical watershed. For Project #1, each team will prepare a one-page summary sheet suitable for duplication as a class handout. All written work for the projects must be word-processed (typed, spell-checked, etc. Each team is responsible for a 30- 45- minute presentation of one project to the class. Students will delineate the watershed on maps using ArcView GIS. Each group will define the problem, i.e. water quality, flooding, etc., and the goals and objectives for addressing the problem. The group will characterize the watershed and provide recommended actions such as best management practices to address the defined problem. The report should be no longer than 10 pages single-spaced with tables and graphs and include at least 2 GIS watershed maps.

Final Term Paper - Watershed Management
Students will write a term paper or prepare a digital product researching a topic in watershed management. The paper should be in two parts. The first part should focus on the history and evolution of watershed management. The second part should present a specific watershed demonstrating an application of approaches that you have learned in class. The focus may be on tenets and trends in watershed management in the United States or internationally. The watershed that you choose may be sub-state, state, interstate, or regional.