

W&FCON 597R WATERSHED SCIENCE AND MANAGEMENT

Spring 2009 TU, TH 11:15 to 12:30

Course teacher: Dr. Timothy Randhir, Department of Natural Resources Conservation

Phone: 413-545-3969 Email: Randhir@nrc.umass.edu

Office Hours: TU, TH 12:30 to 1:30 @ Holdsworth Rm. 320.

Course website: <http://spark.oit.umass.edu/>

Required: (available at the Textbook Annex and also on Reserve at the library)

1. Textbooks:

- a. Brooks *et al.* Hydrology and the management of watersheds (**Third Edition**), Iowa State Press.
- b. Heathcote. Integrated Watershed Management, John Wiley & Sons **2nd edition** – February 2009.

2. **Erserves:** Chapters not covered in the above texts are available at

<http://ereserves.library.umass.edu/>

Course help: Students needing special help are encouraged to contact the instructor.

Course Objectives: a) to develop skills in watershed-based, economic and environmental problem-solving; b) to understand inter linkages between biological, physical, hydrologic and socio economic processes; and c) to develop an inter/trans disciplinary perspective in evaluating and managing watersheds as a system.

Course policy: Students can contact Prof. Randhir for any help through walk-ins, email, or phone call. All students are expected to maintain full attendance. Students are required to inform professor of any absence prior to that class. Excessive absence (more than two classes) without proper reason AND prior permission from instructor will result in a loss in grade. All students are expected to complete quizzes and assignments on time. Late submissions are not encouraged and will affect the grade. The course will follow policies of UMass regarding academic dishonesty (http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).

<i>Day</i>	<i>Lecture Topic</i>	<i>References</i>
Jan 27	Course plan and orientation	
	<i>1. Watershed Basics</i>	
	1.1 Watersheds - definition and scope	Brooks: Chapter 1 pages xiii,3-4; Reimold Chapter 1 (E)
Jan 29	1.2 Integrated watershed management	Heathcote: Chapter 1
	<i>2. Watershed processes</i>	
	2.1 Hydrologic cycle	Brooks: part 1, pages 21-24
Feb 3	2.2 Ecological systems associated with watersheds	Doppelt: Chap 2 (E)
Feb 5	2.3 Biogeochemistry of Watersheds	Molden and Cerny: Chap 1 (E) Kimmins: Chapter 5 pages 71-73. (E)

Feb 10	2.4 Human dimension: Legal, institutional, and administrative issues	Heathcote: Chap 9
Feb 12	2.5 Local and global perspectives	Western: Chap 26& 27 (E) –(see under Olembo and Tarak)
	3. Watershed hydrology	
Feb 17	3.1 Precipitation and interception	Brooks: Chap 2 Pages 26-46.
Feb 19	3.2 Evapotranspiration and soil water storage	Brooks: Chap 3
Feb 24	3.3 Infiltration, runoff, stream flow	Brooks: Chap 4
Feb 26	3.4 Groundwater	Brooks: Chap 5
Mar 3	3.5 Hydrological impacts of Land use	Brooks: Chap 6
Mar 5	3.6 Urban hydrology	Lazaro: Chap 2: p25-35 (web link)
	4. Watershed Ecology	
Mar 10	4.1. Landscape Ecology	Forman; Chap 1 (E)
Mar 12	4.2 Riparian Systems	Brooks: Chap 13
Mar 24	4.3 Wetland Systems	Brooks: Chap 14
Mar 26	4.4 Coastal and Estuarine systems	Alongi, Chap 6 (E)
Mar 31	4.5 Ecosystem and biodiversity impacts	Calrns (E)
	5. Watershed Assessment	
Apr 2	5.1 Watershed inventory	Heathcote: Chap 2
Apr 7	5.2 Watershed modeling	Singh: Chap 1 (E)
Apr 9	5.3 Rural watershed modeling	Haan: Chap 9 (E) – (see under Frere)
	5.4 Urban watershed modeling	Lazaro: Chap 5 (E)
Apr 14	5.5 Tools for watershed analysis	Brooks: Chap 18
	5.6 Environmental and social impact assessment	Heathcote, Chap 10
	6. Watershed Restoration	
Apr 16	6.1 Watershed-scale restoration	Williams: Chap 1 (E)
	6.2 Ecological principles in restoration	Williams: Chap 7 (E) – (See under Frissel)
Apr 23	6.3 Temporal and spatial scales in restoration	Williams: Chap 6 (E) – (See under Ziemer)
	6.4 Structural and non-structural approaches	Lazaro: Chap 6&7 (web link)
	7. Watershed Planning and Management	
Apr 28	7.1 Watershed policy and planning	Brooks: Chap 19 pages 505–532.

	7.2 Public involvement techniques	Heathcote: Chap 4
Apr 30	7.3 Watershed economics	Brooks: Chap 19 pages 532-550.
May 5	7.4 Developing a successful watershed strategy	Reimold: Chap 18. (E) (See under Golden)
	7.5 Developing workable management options	Heathcote: Chap 5
May 7	7.6 Identifying and implementing the best plan	Heathcote: Chap 11, 12
May 12	7.7 Emerging and future issues in watersheds	Discussion

Evaluation:

The final grades will be calculated based on test scores (35%), class project (30%), in-class participation (10%), class exercises (10%), class presentation (10%). Innovation and creativity (new ideas on problem-solving or new approaches to solutions) demonstrated in the course will also be considered in grading.

1. **Quizzes:** 35%
There will be seven quizzes (evaluated as 7*5) in the course. Quizzes will be administered online.
Quiz format: True or False (10*1=10 points), short answers (5*4=20 points), and essay type (2*10=20 points)
2. **Class Project:** 30%
(Students will identify an issue of interest after consulting with Prof. Randhir. Evaluation will be based on timely submission of the report, scientific methods used, and writing. Students should plan to meet with the professor to identify a topic, discuss analytical methods, and write-up. Failure to discuss, incompletes and late submissions will lower points toward the grade)
3. **Class Presentation** 10%
(Presenting and leading a discussion on a major topic in watershed science. Presentations will be scheduled in April)
4. **Class Exercises** 10%
(Attendance and completion of all in-class and assigned exercises)
5. **Class discussions:** 10%
(Attendance and participation in class evaluated based on the leadership exhibited, new ideas discussed, frequency and quality of interaction)
6. **Innovation and Creativity:** 5%
(New ideas and solutions to watershed science contributed by the student. Students are encouraged to discuss these ideas with Prof. Randhir).

Class project reports are due at Prof. Randhir's office (Rm. 320) before 4:30 PM on May 15th.

References:

- Alongi, D.M. 1998. Coastal Ecosystem Processes. CRC Press, New York.
- Brooks, K. N., P. F. Ffolliott, H.M.Gregerson, and L.F. DeBano. 2003. Hydrology and the Management of Watersheds. (Third Edition) Iowa State University Press, Ames.
- Calrns, J. 1993. The Current State of Watersheds in the United States: ecological and Institutional Concerns. In Proceedings of Watershed '93: National Conference on watershed management, Alexandria, Virginia. March 21-24.
- Doppelt, B., M. Scurlock, C. Frissell, and J. Karr. 1993. Entering the Watershed: A New Approach to Save America's River Ecosystems. Island Press, Washington, DC.
- Federer, C.A. 1995. Brook90: A Simulation Model for Evaporation, Soil water, and Stream Flow, Version 3.1. Computer Freeware and Documentation. USDA Forest Service. PO Box 640. Durham, NH.
- Forman, R.T. 1995. Land Mosaics: The Ecology of Landscapes and Regions. Cambridge Univ. Press, Cambridge, UK.
- Haan, C.T., H.P. Johnson, and D.L.Brakensiek. 1982. Hydrologic Modeling of Small Watersheds. ASAE Monograph, American Society of Agricultural Engineers, St. Joseph, Michigan.
- Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1998. John Wiley and Sons, Inc., New York.
- Kimmins. 1997. Forest Ecology. Foundation for Sustainable Management.
- Lal, R. 2000. Integrated Watershed Management in the Global Ecosystem. CRC Press, New York.
- Lazaro, T.R. Urban Hydrology: A Multidisciplinary Perspective. 1979. Ann Arbor Science Publishers Inc., Ann Arbor, Michigan.
- Mass Bays. 1996 Comprehensive Conservation and Management: An Evolving Plan of Action. Mass Bays Program, Boston.
- Moldan, B. and J. Cerny. 1994. Biogeochemistry of Small Catchments: A Tool for Environmental Research. John Wiley and Sons.
- NRC, 1999. New Strategies for America's Watersheds. Commission on Geosciences, Environment, and Resources, National Research Council, National Academy Press, Washington, D.C.
- Ramphele, M. and C. McDowell. 1991. Restoring the Land. The Panos Institute. Panos Publication Ltd, London.
- Reimond, R.J., (Ed). 1998. Watershed Management: Practice, Policies, and Coordination. McGraw Hill.
- Singh, V.P. Computer Models of Watershed Hydrology. Water Resources Publications, Colorado, USA.
- Western, D., and M.C. Pearl. 1989. Conservation for the Twenty-first Century. Oxford University Press, Oxford.
- Williams, J.E., C.A. Wood, and M.P. Dombeck (Ed.). 1997. Watershed Restoration: Principles and Practices. American Fisheries Society, Bethesda, MD.