MEES 617 Hydrological Effects of Land Use Change
(co-listed as BIOL-650-001 at FSU)

Spring 2020 3 credits; Tu/Th (1100-1220); via IVN/ZOOM (all MEES campuses)

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Course Description

Professors Eshleman and Testa are offering a course that addresses one of the major environmental drivers of the past century: land use and land cover change and its effects on the hydrologic cycle. The first half of the course introduces students to fundamentals of land-surface hydrology, including a focus on theories and practices of contemporary catchment science in a changing world; effects on both water quantity and water quality will be examined. The second half of the course focuses on understanding, detecting, and modeling the effects of land use change in downstream receiving waters including the coastal zone (e.g., estuarine responses to nutrient and sediment loads induced by watershed perturbations). Depending on student interests, specific topics to be explored may include: construction and operation of reservoirs and impoundments; deforestation; urbanization; water resources development; agricultural intensification; wetlands conversion; land management; surface mining; and seawater intrusion into coastal aquifers. *Pre-requisites: MEES 640, calculus, and statistics (or permission of instructors).*

Syllabus

Week No.	Dates (approx.)	Topic
1	1/28, 1/30	Course introduction: concepts of hydrological systems and processes; global water cycle; continuity equation;
2	2/4, 2/6	Introduction to the catchment; hydrograph analysis; hydrograph separation; hydrologic tracers; rainfall-runoff relationships; unit hydrographs; *flow timing and estuarine response; freshwater inputs and estuarine salinity*
3	2/11, 2/13	Precipitation: temporal and spatial variability; interception; throughfall and stemflow; snow accumulation and melting; *atmospheric deposition to land and coastal waters*
4	2/18, 2/20	Evaporation and transpiration: meteorological, physiological, and soil moisture controls; liquid-vapor phase changes; energy budget, aerodynamic, and combined methods; Penman-Monteith equation; potential evapotranspiration
5	2/25, 2/27	Groundwater: water movement and distribution in the saturated zone; Darcy's law; unconfined and confined aquifers; groundwater recharge and discharge; *submarine groundwater discharge*
6	3/3, 3/5	Soil moisture: water movement and distribution in the unsaturated zone; role of capillarity; infiltration capacity
7	3/10, 3/12	Streamflow generation mechanisms: infiltration-excess overland flow, saturation overland flow, subsurface stormflow
	3/17, 3/19	*SPRING BREAK—NO CLASSES*
8	3/24, 3/26	Hydrology and water quality: concentration-discharge relationships; pollutant load estimation; *estuarine response scales to pollutant loads*; take-home mid-term due 3/27

Week No.	Dates (approx.)	Topic
9	3/31, 4/2	Hydrological responses to land use conversions and disturbances: application of experimental catchments; empirical/statistical models; mechanistic models; *impacts on tidal nutrients*
10	4/7, 4/9	Deforestation and forest management practices; hydrological and hydrochemical responses; natural disturbances; *sediment impacts on estuaries*
11	4/14, 4/16	Agricultural hydrology and agricultural management practices: hydrological and hydrochemical responses; *nutrient sources and dead zones*
12	4/21, 4/23	Urban hydrology and management: hydrological and hydrochemical responses; stormwater best management practices. Proposed field trip to Plumtree Branch, Ellicott City
13	4/28, 4/30	Wetlands hydrology and management: hydrological and hydrochemical responses; development of surface and subsurface water resources; flood control reservoirs; impoundments; *salt water intrusion; impacts on nutrient export ratios and tidal productivity*
14	5/7, 5/12	Mixed-land use river basins: *analysis and modeling of land-estuary connections*
15	5/14, 5/16	Reading day; final exam

Textbook and Reading Assignments

Readings pertaining to the following week's classes will be assigned each Thursday. A basic textbook in hydrology—*Elements of Physical Hydrology* (1998) by G.M. Hornberger *et al.*—contains many of the assigned readings; students are encouraged to work the *Example Problems* at the end of assigned chapters and study the *Review Questions* (and *Answers*) provided with the HTML version of the textbook on the accompanying CD. Supplemental readings will be assigned regularly from scientific periodicals, reports, and other books. Individual reprints or on-line access to these readings will be provided to students for personal use only through *Moodle* or *Google Classroom*. Readings should be completed before class to promote in-class discussion.

Course Requirements

- Exams. One mid-term and one final examination will be given. It is intended that each examination will require approximately equal amounts of analytical, quantitative, and writing skills.
- Other assignments. Five take-home assignments will be given during the semester (approximately one every 3rd week). Most of these will require basic graphics/statistics software (e.g., *MS-Excel*), and a web browser. Students familiar with other analytical software packages (e.g., *R*, *Matlab*) are welcome to use these as well.
- Grading policy. The course grade will be computed from a weighted-average of the two exam scores, the take-home assignment scores, and a class participation score as follows:
  - Class participation: 15%
  - Mid-term examination: 25%
  - Final examination: 35%
  - Take-home assignments: 25%
- Moodle/Google Classroom. All course materials, important announcements, and last-minute messages will be distributed to students on-line via the courseware server or by e-mail.