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Syllabus: Sustainable Green Infrastructure Planning and Design

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Sustainable Green Infrastructure Planning and Design

LA 591I/RP 591I

Spring 2013

TTh 2:30-3:45

Instructor: **Robert L. Ryan, Professor**
Office- 315 Hills North, 545-6633, e-mail: rlryan@larp.umass.edu
Hours- T.B.A. and by appointment

Credits: 3.0 units

Overview

Green infrastructure planning requires a systems approach to improving ecological function while providing vital ecosystem services for human populations. This course will introduce students to the concepts, theories, and applications of greenway and green infrastructure planning at multiple scales, including the site-level, neighborhood, and regional scales. A particular area of focus will be the relationship of green infrastructure for improving hydrology and riparian corridors as part of comprehensive green space planning for recreation and cultural resources. The course will look at a wide range of systems including water, transportation, and food systems. A case study approach will be used to study green infrastructure projects both domestically and internationally from a planning and policy perspective, as well as implementation.

Goals

1. To help students understand how the concept of green infrastructure developed and put it relationship to the larger historical framework of environmental planning and sustainable development.

2. To give students the introductory tools to conceptually plan a green infrastructure system; evaluate policies; and develop implementation strategies.

3. To help students recognize that the human component of sustainable, multifunctional landscapes is critical both for human health and for long term ecological preservation.

4. To show students how to incorporate multiple spatial scales thinking for understanding ecological systems and when applying them to design and planning problems.

5. To give students a beginning understanding of the economic impacts and benefits of multi-functional green infrastructure planning.

Class format: The class will include lectures and discussions about our course readings. In addition, we plan on having a few local fieldtrips to visit some examples of green infrastructure projects. The case-study approach to green-infrastructure means will involve reading about green infrastructure theory/ concepts than looking at examples of built green infrastructure projects.

Readings

Text Books

Benedict, Mark A. and McMahon, Edward T. 2006. *Green Infrastructure: Linking Landscapes and Communities*. Washington: Island Press.

Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Hoboken, NJ: Wiley Press.*

These required texts are available at the Amherst Books, 8 Main St.
* Sarté is also available as an e-book from the University Library.

Course Reader: Other course readings are available on electronic reserve at the University Library web-page: http://ereserves.library.umass.edu/. You will need a password to access these reserves. The password will be given out at the first class meeting.

Schedule

Week 1: Overview/Greenway definitions

Jan. 22 – Overview, goals and objectives, definitions of green infrastructure

- Benedict & McMahon, 2006, *Green Infrastructure: Linking Landscapes and Communities.* Chapter 1: Why Green Infrastructure? (pp. 1-22).

Jan. 24 – Brief history of green infrastructure

- Benedict & McMahon. 2006. *Green Infrastructure: Linking Landscapes and Communities.* Chapter 2: The Green Infrastucture Approach: Principles from Past to Present (pp. 23-55).
- Hill, K. 2007. Urban ecological design and urban ecology: an assessment of the state of current knowledge and a suggested research agenda. In *Cities of the Future: Towards Integrated Sustainable Water and Landscape*, IWA Publishing (pp. 251-260).
- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 1: The Process of Sustainable Engineering Design (pp. 1-18).

Week 2: Building the Case for Green Infrastructure: State of the Planet

Jan. 29- History of the development of green infrastructure continued, emphasis on the environmental and green movements.

- Readings about the Clean Water Act and Clean Air Act (links to be provided).
- McCarty, John P. 2001. Ecological consequences of recent climate change. *Conservation Biology* 15, 2, 320-331.
- Vorosmarty, Charles J., Green, Pamela, Salisbury, Joseph, Lammers, Richard. 2000. Global water resources: vulnerability from climate change and population growth. *Science* 289, 284-288.

Jan. 31- Introduction to landscape ecology and resilience

- Forman, Richard T.T. 2008. *Urban Regions: Ecology and Planning Beyond the City*. New York: Cambridge University Press. Pgs 1-26.
- Alberti, M & Marzluff, J. 2004. Ecological resilience in urban ecosystems: linking urban patterns to human and ecological functions. *Urban Ecosystems* 7, 241-265.

Week 3

Feb. 5- Landscape ecology (continued)

- Czerniak, Julia. 2006. Looking back at landscape urbanism: speculations on site. In *The Landscape Urbanism Reader*. Edited by Charles Waldheim. New York: Princeton Architectural Press (pp. 106-123).
- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 2: Sustainable Infrastructure Frameworks (pp. 19-56).

Feb. 7- - Solid waste management: Potential fieldtrip to composting facilities/ Umass/ Amherst (T.B.A.)

- U.S. EPA- Municipal Solid Waste Information. Available online at http://www.epa.gov/epawaste/nonhaz/municipal/index.htm

Week 4: Hydrology

Feb. 12- significance of spatial scale and multi-functionality, introduction to hydrology as a system that is influenced by human development at multiple scales

- Benedict & McMahon. 2006. *Green Infrastructure: Linking Landscapes and Communities.* Chapter 3: The Benefits of a Green Infrastructure Approach (pp. 57-84).
- USGS: Summary of the Water Cycle - http://ga.water.usgs.gov/edu/watercyclesummary.html
- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 3: Water Conservation and Supply (pp. 57-93).

Feb. 14- hydrology continued, emphasis on green infrastructure solutions to wastewater problems

- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 4: Integrated Water Management (pp. 96-163).
- Example of watershed management in Massachusetts: Ipswich River Restoration - http://www.mass.gov/dcr/watersupply/ipswichriver/index.htm

Week 5: Urban agriculture

Feb. 19- No class: Monday schedule followed for Presidents' Day

Feb. 21- Current issues with food networks and green infrastructure solutions (Guest lecturer: Sustainable agriculture)

- Resource Centres on Urban Agriculture & Food Security. 2006. Cities Farming for the Future – Urban Agriculture for Green and Productive Cities. Available online at http://www.ruaf.org/node/961
- Rosenzweig, Cynthia & Parry, Martin L. 1994. Potential impact of climate change on world food supply. *Nature* 367, 133-137.

Week 6: Transportation and Energy

Feb. 26- Transportation

- Federal Highway Administration, Federal Transit Administration, Livability in Transportation Guidebook: Planning Approaches that Promote Livability. Available online at http://www.fhwa.dot.gov/livability/case_studies/guidebook/livabilitygb10.pdf
- Mossop, Elizabeth. 2006. Landscapes of infrastructure. In *The Landscape Urbanism Reader*. Edited by Charles Waldheim. New York: Princeton Architectural Press (pp. 171-177).

Feb. 28- Energy

- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 5: Energy and Greenhouse Gases (pp. 166-205).

Week 7: Climate

March 5- Climate mitigation at the local and regional level

- Foster, J., Lowe, A., & Winkelman, S. 2011. The value of green infrastructure for urban climate adaptation. Center for Clean Air Policy.

- Laukkonen, J., Blanco, P.K., Lenhart, J., Keiner, M., Cavric, B., Kinuthia-Njenga, C. 2009. Combining climate change adaptation and mitigation measures at the local level. *Habitat International* 33, 287-292.
- Gill, S.E., Handley, J.F., Ennos, A.R., and Pauleit, S. 2007. Adapting cities for climate change: the role of the green infrastructure. *Built Environment* 33,1, 115-132.

March 7- Micro-climate regulation (Department studio presentations)

- Georgi, N.J. & Zafiriadis, K. 2006. The impact of park trees on microclimate in urban areas. *Urban Ecosystems* 9, 195-209.
- Reducing Urban Heat Islands: Compendium of Strategies. Urban Heat Island Basics. http://www.epa.gov/heatisld/resources/compendium.htm

Week 8: Human health and well-being

March 12 – Health, wellness and restorative landscapes

- Tzoulas, Konstantinos, Korpela, Kalevi, Venn, Stephen, Ylipelkonen, Vesa, Kazmierczak, Aleksandra, Niemela, Jari, and James, Philip. 2007. Promoting ecosystem and human health in urban areas using green infrastructure: a literature review. *Landscape and Urban Planning* 81, 167-178.
- Frumkin, Howard. 2003. Healthy places: exploring the evidence. *American Journal of Public Health* 93, 9, 1451-1456.
- Jackson, Laura E. 2003. The relationship of urban design to human health and condition. *Landscape and Urban Planning* 64, 191-200.

March 14 – Recreational landscapes

- Bedimo-Rung, Ariane L., Mowen, Andrew J., Cohen, Deborah, A. 2005. The significance of parks to physical activity and public health. *American Journal of Preventative Medicine*, 159-168.
- Moore, Roger L. and Ross, D. Thomas. 1998. Trails and recreational greenways: corridors of benefit. Parks & Recreation 33, 1, 68-79.

Mid-term Examination (tentative date)

Spring Break: March 17-24

Week 9 Cultural Landscapes and Green Infrastructure

March 26 – Cultural landscapes

- Birnbaum, Charles A. 1994. *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes.* National Parks Service, U.S. Department of the Interior. Available online at http://www.nps.gov/history/hps/tps/briefs/brief36.htm

- Vos, W. & Meekes, H. 1999. Trends in European cultural landscape development: perspectives for a sustainable future. *Landscape and Urban Planning* 46, 3-14.

March 28 – Perception of sustainable landscapes and building public acceptance
- Ryan, R.L. The role of place attachment in sustaining urban parks. In *The Human Metropolis: People and Nature in the 21st-Century City*. 61-74.
- Additional readings (2) to be handed-out.

Week 10 Greenways

April 2 – Introduction to greenways
- Fabos, Julius Gy. 1995. Introduction and overview: the greenway movement, uses and potentials of greenways. *Landscape and Urban Planning* 33, 1-13.
- Ahern, Jack. 1995. Greenways as a planning strategy. *Landscape and Urban Planning* 33, 131-155.

April 4 – Multi-functionality of greenways
- Burel, F. & Baudry, J. 1995. Social, aesthetic and ecological aspects of hedgerows in rural landscapes as a framework for greenways. *Landscape and Urban Planning* 33, 327-340.
- Greenway case studies (optional field-trip day).

Week 11 International greenway: Planning and design

April 9 – Planning and designing greenways
- Benedict & McMahon. 2006. *Green Infrastructure: Linking Landscapes and Communities.* Chapter 5: The Basics of Network Design (pages 109-147).
- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 6: Sustainable Site Planning, Built Systems, and Material Flows (pp. 208-238).

April 11 – Greenways: an integral part of sustainable community development
- Sarté, S.B. 2010. *Sustainable Infrastructure: The Guide to Green Engineering and Design*. Chapter 8: Applications for Sustainable Communities (pp. 294-324).

April 12-13, 2013: Fabos Conference on Landscape and Greenway Planning: Pathways to Sustainability, UMass Campus Center (Attend 3 sessions min.)
http://blogs.umass.edu/faboslgpconf/

Week 12 Economic Aspects of Green Infrastructure

April 16- Economy and green infrastructure

- Moffatt, Ian. 2000. Ecological footprints and sustainable development. *Ecological Economics* 32, 359-362.
- Schilling, Joseph and Logan, Jonathan. 2008. Greening the rust belt: a green infrastructure model for right sizing America's shrinking cities. *Journal of the American Planning Association* 74,4, 451-466.

April 18 – Economy and green infrastructure continued
- Lindsey, Greg and Knapp, Gerrit. 1999. Willingness to pay for urban greenway projects. Journal of the American Planning Association 65, 3, 297-313.

Week 13 Land Use Planning and Policy related to Green Infrastructure

April 23- Land use and zoning- current limitations in most urban areas
- Ryan, Robert L., Fabos, Julius Gyula, Allan, Jessica Jo. 2006. Understanding opportunities and challenges for collaborative greenway planning in New England. *Landscape and Urban Planning* 76, 172-191.
- Green Infrastructure Tool-kit: Arc of Innovation (link to be provided)

April 25 – Land use and zoning regulations that support green infrastructure
- Benedict & McMahon. 2006. *Green Infrastructure: Linking Landscapes and Communities.* Chapter 6: The Implementation Quilt: Matching Available Resources to Network Needs (pp. 149-195).

Week 14

April 30 – Class synthesis: Greenways and green infrastructure
Final Project due

Requirements

Assignments	20%
Mid-term examination	30%
Final project	30%
Active reading notes	10%
Class participation	10%
Total	100%

Problem-solving assignments: We will have two brief assignments involving gathering case-studies of green infrastructure as part of our field trips/ web-based research. More details will be handed out in class.

Mid-term examination: The first half of the course focuses on general subject areas related to green infrastructure. The mid-term exam will be a mix of open ended, problem-solving questions, along with close-ended questions about the facts of

these subject areas. Your critical thinking questions will be extremely useful in studying for this exam.

Final project: Since this course is focused on helping students address "real-world" environmental problems while accommodating human needs, it will have a final project that allows students to synthesize the skills and knowledge they have learned in the class to an actual site/situation. Students will be able to choose their own site and general topic related to the course; and write a report discussing how they would address this environmental problem using a multi-functional green infrastructure solution. Further details on this final project will be handed out later in class.

Active reading and critical thinking: *In order to insure that students are prepared for class discussion, they will be expected to come prepared with a list of 3-5 summary points from each assigned reading.* As critical thinkers, this could include questions that were raised by the authors; disagreements you may have with what the author said; or connections from this reading to others in our class. At the beginning of the class, you will turn these summary points in written form; we will transition to an electronic-format for sharing with the entire class later in the semester.

Class participation: Students are expected to attend class on a regular basis. Unexcused absenteeism will result in a lower grade. Our course readings will form the basis for lectures and discussions. Therefore, students are expected to have completed the readings prior to class time and be active participants in class discussions. In addition, students are expected to attend the Fabos Conference on Landscape and Greenway Planning and summarize 1-2 talks for our next class.

Grading Allocation from total points possible in the course. Criteria include completeness of work, grammar, punctuation, critical thinking, organization, and application of course readings and lectures.

A = 92.5-100%
A- = 90.0-92.5%
B+ = 87.5-89.9%
B = 82.5- 87.5%
B- = 80.00- 82.5%
C+ = 77.5%- 79.9%
C = 72.5- 77.5%
C- = 70.00- 72.5%
D+ = 67.5%- 69.9%
D = 62.5- 67.5%
D- = 60.00- 62.5%
F= under 50%

Unless prior accommodation has been made, according to University policy listed below, late assignments will receive a lower grade of 2.0% for each class

period that they are late. In addition, students will receive an incomplete and/or failing grade in the course if they have not completed all assignments and submitted hard-copy assignments to the instructor by the beginning of finals.

Accommodation Policy Statement

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

Graduate School Interim Statement on Academic Honesty

It is expected that all graduate students will abide by the Graduate Student Honor Code and the Academic Honesty Policy (available at the Graduate Dean's Office, the Academic Honesty Office (Ombud's Office) or online at http://www.umass.edu/gradschool/handbook/univ_policies_regulations_a.htm). Sanctions for acts of dishonesty range from receiving a grade of F on the paper/exam/assignment or in the course, loss of funding, being placed on probation or suspension for a period of time, or being dismissed from the University. All students have the right of appeal through the Academic Honesty Board.