EVPP 442/542-BIOL 442 **SP 2020**

Urban Ecosystems and Processes

INSTRUCTOR:	**Dr. Changwoo Ahn**
	Professor of Environmental Science and Policy
OFFICE:	DK 3034 (office hour: Tue. 2-4 pm or by appointment)
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CLASS TIME:	Lecture/discussion: **Tuesdays** 4:30 -7:10 pm
	Fields/Lab: **Saturday** 10:30AM- 1:10 PM
CLASS LOCATION:	Mason Global Center 1320C
	DK2054/Field Sites
CREDIT HOURS:	4

PREREQUISITE: CHEM 211 or 213 General Chemistry, Math 113 (calculus) or equivalent, BIOL 307 or EVPP 302, PHYS 243 or equivalent. In case of not meeting prerequisite requirements, permission of instructor is required to take the course. Please see me if you have any questions concerning this.

COURSE DESCRIPTION:
This undergraduate/graduate course will provide an overview and introduction of challenges and opportunities we face in urban environments. The course describes general ecosystem ecology for cities along with review on urban metabolisms of energy, water, soil, and foods with cultural and historical contexts. Especially, the course focuses on urban water cycles and nutrient dynamics that are critical in urban ecosystem functioning involving streams, rivers, and wetlands. The course also aims to review and discuss numerous cases of urban coupled natural and human (social) processes and their relationship with design elements that can be incorporated into creating functional urban landscape. The course will engage students in studying up-to-date information on urban ecological planning and green infrastructure implementation through field trips and visits. The course provides students with an understanding of systemic, interdisciplinary approaches for designing and managing urban ecological processes.

COURSE OBJECTIVES: the course is intended to involve students in:

1) A firm grasp of ecological principles for the built environment by *studying* relevant contemporary issues through peer-reviewed journal articles, news articles, and other literature;

2) An understanding of ecological processes to create and restore ecosystem services related to water, energy, and food and/or;

3) Conducting a small-scale ecological experiment and/or intense literature-based project on the campus or in local areas throughout the semester with a relevant theme that will be provided by the instructor

RECOMMENDED TEXT

Adler FR, Tanner CJ. Urban Ecosystems –Ecological principles for the Built Environment. 2013. Cambridge University Press.
Richard T. T. Forman. 2019. Urban Ecology: Science of Cities, Cambridge
Robert I. McDonald. 2015 Conservation for Cities. Island Press.
Travis Beck. 2013. Principles of Ecological Landscape Design. Island Press (PDF available)
Pickett STA et al. 2019. Science for the Sustainable City. Yale University Press.
Pickett STA et al.(eds.) 2013. Resilience in Ecology and Urban Design. Springer.

Useful links for resouces

https://www.edge.org/conversation/jonathan_b_losos-urban-evolution
https://www.thenatureofcities.com/ -The Nature of Cities blogs
The Dirt (ASLA newsletter: https://dirt.asla.org/ (ASLA website)- **selected categories**!
https://dirt.asla.org/2019/03/11/to-improve-resilience-communities-go-to-green-infrastructure/

RECOMMENDED JOURNAL SOURCES (e.g., available via Web of Science)
Urban Ecosystems, Journal of Urban Ecology, Ecological Engineering, Nature-Sustainability, Sustainability, Landscape and Urban Planning, Journal of Environmental Management, Building and Environment, Urban Forestry and Urban Greening

COURSE FORMAT: Class will be a mixture of lecture, intensive paper reading and discussion, case studies presentation, field trips/visits/reports, and an urban ecosystem and/or process project with presentations. There may be some occasional homework assignments. I expect you to complete the assigned readings prior to each class. Each class participant will be required to participate in a class project and prepare presentations on the outcomes of the project. Grades will be based on paper review summaries and presentations, field trip reports, mid-term, group activities for final project, final project outcome and its presentation. The course may also involve one longer, field trip, depending on logistics and class discussion (TBD).

READING ASSIGNMENT FOR CLASS AND PAPER DISCUSSION:

Each student is required to submit summaries of papers or book chapters assigned before class. Each written summary will be 2 pages top, 800-1,000 words limit, single spaced, 1' for all margins with 11 or 12 font size –DO NOT copy and paste from the paper for your summary. You can hand the print-outs of your summary of the article to the instructor right before class. Your summary of the chosen paper should include **two** questions (one answered by you) of yours at the end of the summary on terminology, concepts and interpretation of the results presented in each paper. The group that presents a paper summary will lead a discussion session after the presentation with instructor's moderation. The group will go over some of the questions from the class. In addition, we will read some papers together more thoroughly along with lectures in an investigative mode.

FINAL PAPER/PROPOSAL AND PRESENTATION:

Each student is required to write a research paper (undergrad student) or a grant proposal (graduate student- following NSF Environmental Sustainability proposal format) on a specific subject of urban ecosystem processes with intense literature review as part of the class for grades. Specifics on the subject and the format will be explained and discussed during the course of the class. Power point presentation of each paper is also required (15-20 minute presentation and 5 minutes Q &A). Students are allowed to use a variety of media, including photos, videos, and web blog to be created to tell a story of the project with further discussion with the instructor. Email me ppt files at least a couple of days before final presentation (**April 28)** for my feedback. Your final paper/proposal (& ppt)/ is due by **May 7 (to be emailed by noon)**. **No late assignment will be accepted**.

Your final project proposal is due Feb 25: the proposal should include the topic, a conceptual model, and on-going literature review. 2 pages, to be discussed with instructor.

HANDOUTS: Copies of papers and other documents will be handed out in conjunction with class lectures. Unless otherwise noted, students are generally responsible for material contained in these handouts for course examinations.

COURSE POLICY AND EXPECTATIONS

Class attendance is strongly recommended. Be punctual. Lateness is disruptive and disrespectful to your peers and to me. There will be strong emphasis on active and effective **participation** in class discussions, not only during the class presentations and discussion periods following these presentations, but also throughout all the other class periods. I expect each of you to be present and prepared for each class. This will involve having read the assigned material before each class. I strongly recommend not to use your cell phones during the class. *Academic dishonesty* will not be tolerated (honor code responsibilities). *Minor changes in course organization and content* may be required throughout the semester, thus students will be made aware and asked for input if such actions are needed. **No late assignment will be accepted**.

LET ME KNOW if you have any documented learning or other disability and wish to discuss academic accommodations. The Disability Resource Center can also help you or direct you toward help with a wide range of learning, studying, mental health, career, and physical disability issues (located in Student Union Building I, Room 2500; Tel: 703- 993-2474; http://ods.gmu.edu/).

CLASS E-MAIL AND COMMUNICATING WITH ME:

I will frequently e-mail to remind you of deadlines or to clarify points from a lecture. Please use GMU e-mail (**@gmu.edu) to facilitate any communication or discussion. Please check your e-mail **daily**. When you email your assignments, be sure to label your file with your last name, date, and course number (e.g., ahn0121-442). If you email a question of general interest, I will likely send my response to the entire class list. Be sure to take full advantage of your classmates, the library, and the web as learning resources. Finding answers and solutions among yourselves by tapping into the multitude of resources available to you is generally a more gratifying and educationally valuable approach than seeking answers from a single authority.

LABS & FIELD TRIPS:

Students are required to participate in scheduled field trips and fieldworks, and to do lab assignment as necessary. Field trips are usually scheduled for Saturdays 10:30 AM – 1:10 PM. Based upon previous experience field trips to the locations may end by around 12:45 PM, but some field trips may take longer than the regular class hour. Instructor will discuss about the field trips before they occur. Additional work in any of lab or fields should be arranged with both Dr. Ahn and Dr. Ahn's TA (Stephanie Schmidt) as necessary for your class project if needed. Limited yet laboratory space for your class project work, if needed, can be made available in Ahn Wetland Ecosystem Lab (3071 and 3079a David King Hall). Coordination with Dr. Ahn on lab and equipment use is imperative.

Most field trips involve visiting green buildings, homestead, and green infrastructure sites, which may involve walking on fields, so you may want to wear shoes that can get wet or soiled. Transportation will not be provided for local field trips, car-pooling is strongly recommended. The cost of food (water and lunch) and your share of the transportation costs (i.e., gas) are at your own expense.

Also needed for field trips may include field notebook (e.g., paper or electronic –phone, pads), camera (or your smartphone that can take pictures and videos), pencil, calculator and/or just your smartphone with photo-taking capacity. Old clothes and boots/shoes for fieldwork, rain gear upon weather conditions may be needed in some situations.

LAB REPORT

Each field/lab activity will require a written report with photos (and/or videos if relevant) incorporated when possible (2500 words limit with photos/videos) that will be due by next field/lab session. I am open to the format and style of the submission. We will discuss more about it during the class, but photo journal documentation is strongly recommended with well-summarized and edited wording. Specific instruction will be provided for each field trip with addresses and directions for the locations prior to the trip

GRADING: (subject to minor changes) - I: Individual, G: Group

% of Grade for Undergraduates

Literature review and presentation (I/G)	25 (15/10)
Mid-term (I)	20
Fields/Lab report/Field work (I/G)/	15
Homework*(G)	10
Final Project Paper (I) and presentation (G)	30 (15/15)
TOTAL POINTS	100

% of Grade for Graduates

Literature review and presentation (I/G)	25 (15/10)
Mid-term (I)	20
Fields/Lab report/Field work (I/G)	15

Research assignment (I)	15
Final Project Proposal (I) and presentation (G)	30 (20/10)
TOTAL POINTS	100

LECTURE COURSE SCHEDULE: subject to minor changes

Date	Topic
Jan 21	Syllabus orientation, Introduction, Student backgrounds, group assignment, research topics, field sites, writing center
Urban Ecosystems and the Science of Ecology	
Jan 28	Cities are the future, Ecological future of cities, LTER urban ecosystems (Baltimore vs. Pheonix), Writing center (6:30 pm),
Feb 4	The science of urban ecology (In, Of, and For Urban Ecology), Ecology of and for Cities. **Paper review 1**
Urban Ecosystem Processes	
Feb 11	Urban climate, water cycle, and stormwater management -The case of the Rain Project and its application –urban stormwater management & Campus green Infrastructure, **Paper review 2 -** URSP deadline for undergraduate research and scholarship (for SU 2020 –Feb 19)
Feb 18	Urban nutrient dynamics and basic biogeochemistry, urban soils (carbon) accidental urban wetlands, **Paper review 3**
Feb 25	Urban Soil Ecology and processes, The Dirt project (20 minutes-Stephanie Schmidt), final project proposal due.
Mar 3	Urban evolution video (40 min.), urban biodiversity, urban wildlife (guest lecture-Dr. Travis Gallo -4:30-5:30 pm),
Mar 10	***Spring Break***
Mar 17	**Mid-term (4:30 pm- 5:30 pm)** & lecture (video for urban landscape design-Travis Beck)
Mar 24	Urban watershed, Guest lecture-Mr. Kurt Moser (Four Mile Run Conservancy) – **Paper review 4**
Urban Ecological Design & Communication/ Food	
Mar 31	Urban art sustainability projects: Levy's NYC flow path, Waterwash (Ball), Urban Invasive plants art (Ellie Irons)
Apr 7	Urban Food, P-cycle, Urban Farms, Guest lecture on Sustainable Homestead by Lenna Storm, – **Paper review 5**
Ecological Sustainability and Resilience in Urban environments	
Apr 14	System ecology, Ecological Resilience and resilient cities, Climate Crisis and Coastal Cities – **Paper review 6** (the entire class)- Sponge City https://dirt.asla.org/2019/09/23/nature-is-our-best-defense-against-climate-change/

Apr 21	Final project discussion, writing workshop, breakout sessions (TBD)
Apr 28	Class final project presentation

May 7 **FINAL PAPER/PRODUCT DUE (to be emailed by noon)**

LAB/FIELD COURSE SCHEDULE (subject to minor change):

Date	Locations	Topics and activities
Jan 25	No class	
Feb 1	No class	
Feb 8	Visit Ahn Mesocosm Compound and Campus BMP tour (Facilities –Zhongyan Xu)	
Feb 15	No class	
Feb 22	Individual work, TBD	
Feb 29	No class	
March 7	No class	
Mar 14	**Spring Break**	
Mar 21	WSSI Green Building Tour (Gainesville, VA) – urban stormwater management	
Mar 28	Four Mile Run-Arlington Wastewater Treatment (TBD)/Oak Spring Garden Foundation	
Apr 4	11th Street Bridge Park, DC (https://bbardc.org/project/11th-street-bridge-park/) or City of Norfork or Four Mile Run Conservatory -TBD	
Apr 11	UDC Urban Sustainability- Dr. Dwane Jones	
Apr 18	TBD	
May 2	Final Presentation (TBD)	

Writing Center

Take advantage of the Writing Center as you work on written assignments in this course. You can book free 45-minute appointments with tutors who will work with you on any phase of a writing project. Tutors can help you brainstorm, provide feedback on a draft, answer your questions, and show you strategies for organizing, drafting, revising, and editing. In addition to free individual tutoring sessions, the center has a website that offers resources for writers. To schedule an appointment, visit the center's main location in Robinson Hall B 213, or go to writingcenter.gmu.edu, register with the center, and make an appointment using the online scheduler.

General References

Ahn C, Schmidt S. 2019. Designing urban wetlands as an infrastructural element for urban development in the era of climate change. Special Issue of Sustainable Environmental Engineering: Critical, Interdependent Infrastructure Sustainability and Resilience, *Sustainability* 11, MDPI, Open Access Journal, vol. 11(7), pages 1-10, March

Brendan Borrel. 2015. The Urban Water Crisis- and what we can do about it. Nature Conservancy August/September Issue

Childers DL et al. 2011. Sustainability challenged of phosphorus and food: Solutions from closing the human phosphorus cycle. BioScience (61):117-124.

Childers DL et al. 2015. An ecology for cities: A transformational nexus of design and ecology to

advance climate change resilience and urban sustainability. Sustainability 7:3774-3791.
Childer DL et al. 2014. Advancing urban sustainability theory and action: challenges and opportunities. Landscape and Urban Planning 125 ;320-28.
Edmondson JL et al. 2012. Organic carbon hidden in urban ecosystems. Scientific Reports 2:963.
Ellis, EC. 2016. Cultures of nature: What does it mean to be native in the city?
Felson AJ et al.2013. Mapping the design process for urban ecology researchers. BioScience 63(11): 854-863.
Foderado LW. 2014. In a Queens Forest, Compiling a Picture of Urban Ecology. The New York Times. Dec. 2.
Forman, R. T. T. 2016. Urban ecology principles: Are urban ecology and natural area ecology really different? *Landscape Ecology* 31: 1653-1662.
Guardian. Jam 15, 2020. The case for ... making low_tech 'dumb' cities instead of 'smart' ones.
Green TL et al. 2016. Insurance value of green infrastructure in and around cities. Ecosystems.
Hogan D and Walbridge MR. 2007. Urnization and nutrient retention in freshwater riparian wetlands. 17 (4): 1142-1155.
Jon Chistensen. 2016. Ecological Urbanism for the 21st Century. The Chronical of Higher Education (the Chronical review)
McAndrew B, Ahn C, Spooner J. 2016. Sediment and nitrogen capture performance of a floating treatment wetland for sustainable stormwater management in an urban environment – the case of the Rain Project. *Sustainability* 8 (10), 972; doi: 10.3390/su8100972
McDonald R. 2008. Global urbanization: can ecologists identify a sustainable way forward? Front Ecol Environ 2008; 6(2): 99–104, doi:10.1890/070038
McDonald R. 2014. Water on an urban planet: Urbanization and the reach of urban water infrastructure. Global Environmental Change 27 (2014) 96–105.
McDonald R et al. 2016. Estimating watershed degradation over the last century and its impact on water-treatment costs for the world's large ctities. PNAS 113 (#2): 9117-9122.
McDonnell MJ and McGregor-Fors I. 2016. The ecological future of cities. Perspetive. Science 352 (6288): 936-938.
Mcphearson TM et al. 2016. Advancing urban ecology toward a science of cities. BioScience 66 (3): 198-212.
Menno Schilthuizen. 2016. Evolution is happening faster than we thought. Sunday Review. The New York Times (July 23, 2016).
Mills et al. Urban Habitat restoration providea human health benefit through microbiome rewilding: the Microbiome Rewilding Hypothesis. Restoration Ecology 25 (6): 866-872.
Murray HM et al. 2019. City sicker? A meta-analysis of wildlife health and urbanization. Frontiers in ecology and Environment 17 (10): 575-583.
Nadia Schou Vorndran Lunc. 2019. Integrated stormwater inflow control for swers and green structures in urban landscapes. Nature Sustainability.
Ogden L et al. 2013. Global assemblages, resilience, and earth stewardship in the Anthropocene. Frontiers in Ecology and Environment 11(7): 341-47.
Pickett STA et al. 2014. Ecological resilience and resilient cities. Building Research and Information 42 (2): 143-157.
Pollack K. 2016. Urban physics. Nature 531:S64-S66.
Smith RM and Kaushal SS. 2015. Carbon cycle of an urban watershed: exports, sources, and metabolism. Biogeochemistry DOI 10.1007/s 10533-015-0151-y
Steiner F et al. 2013. The ecological imperative for environmental design and planning. Frontiers in Ecology and environment 11(7): 355-361.
Suchy AK et al. 2019. High potential nitrate removal by urban accidental wetlands in a desert city: limitations and spatiotemporal patterns. Ecosystems

Topics for final projects: SP 2020 –to be discussed further

The urban ecosystem or processes unseen –case studies designed by Dr. Ahn

1. Urban accidental wetlands & urban flooding in coastal cities [e.g., coastal city (Norfork, VA) and its resilience plans]
2. Urban Water, Food, and Energy –water in the city (e.g., Flint, Michigan).
3. Urban Ecosystem/Habitat Restoration and its communication