

Urban Sustainability
NRE 501: Syllabus
University of Michigan

Fall 2014

Monday 1:00pm-4:00pm, Dana 1006

3 Credits

Instructor: Professor Joshua Newell
School of Natural Resources &
Environment

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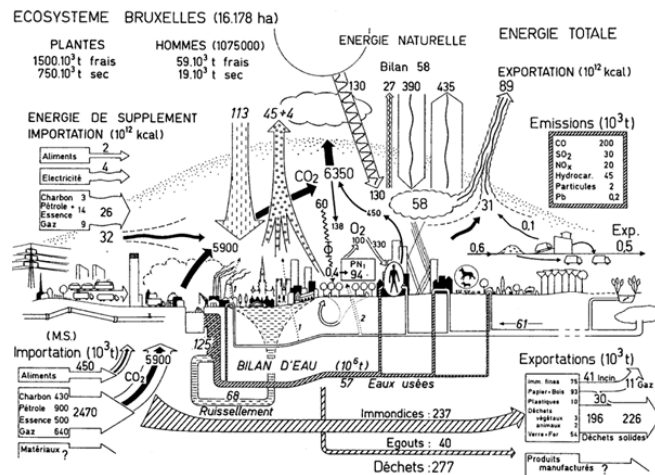
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Course Description

As engines of capital accumulation, cities have often been viewed as environmental sacrifice zones. Some critics have argued that ‘sustainable cities’ is an oxymoron. Nonetheless, the debate over sustainable development generally, and sustainable urbanism specifically, has succeeded in reshaping and broadening discourse around cities and attendant policies and outcomes – both in industrialized and industrializing countries. Implying that sustainable use of natural resources involves social justice and economic development as well as environmental concerns, the notion of sustainability has led away from narrower conceptions of urban environmentalism, toward more consideration for the future, greater integration of social and economic goals with environmental and ecological objectives, and hence a fundamental rethinking of how cities should be theorized, planned and managed.

This course introduces graduate students to the emerging field of urban sustainability from multiple disciplinary perspectives, primarily industrial ecology, urban political ecology, urban ecology, and planning. The course provides students with the theoretical and methodological tools in which to explore the potential for a sustainable urbanism. Approaches to foster more sustainable and resilient forms of urbanization and urban life – ranging from localization, to industrial symbiosis, to ecological restoration – will be introduced and evaluated. The theme of this year’s course is “Urban Metabolism” and students will be exposed to literature that conceptualizes the city through this lens. There is a focus on experiential learning, with two site visits to Detroit during which students are asked to view the city from varying disciplinary viewpoints, frameworks, and methodological approaches.



Urban Metabolism of Brussels, Duvigneaud and Denaeayer-De Smet (1977).

Learning Objectives

By the end of this course, you should be able to:

1. Connect sustainability concepts and technology to real-world urban challenges, including individual/social needs and political debates;
2. Understand the importance (and difficulty) of defining and fostering “urban sustainability”;
3. Present complex material to a diverse audience in a succinct and effective manner;
4. Facilitate effective discussions, while being attentive to diverse opinions and perspectives;
5. Read and write more effectively, both essential skills for your future.

Course Structure

The course is divided into three interdependent sections: 1. *Concepts and Approaches of Urban Metabolism*; 2. *Urban Resource Flows and Form*; and 3. *Towards an Integrative Approach for a Sustainable Urban Metabolism*. The course meets once a week for three hours and is discussion based, focusing heavily on the required readings. The course has an experiential component consisting of two field trips to Detroit and periodic in-class exercises. The primary deliverables, which are graded, are as follows: 1) Course participation; 2) Discussion leadership; 3) Reading responses; 4) and a Research paper.

Course Participation

All students are expected to attend and participate in the scheduled class sessions. Unexcused absences will be reflected in final grades. Attendance will be taken each week. In order to participate fully, completing the required reading for each session is essential.

Discussion Leadership

Each week, 1-2 students will work together to:

- a) Prepare a 15-minute presentation on the week’s major concepts, based on the assigned readings. *You may use PowerPoint if you wish, although you are by no means required to do so.*
- b) Prepare and distribute a handout with an agenda for discussion. *These handouts should include 3-5 discussion questions/points. In addition to the readings, for both the presentation and the handout, please feel free to draw on a range of outside sources (e.g. websites, etc.). Just be sure that you carefully evaluate these sources before using them.*

These discussions will last approximately 90 minutes, so be sure that you have prepared the right amount of material (e.g. questions, points). All students are expected to complete the readings and be prepared to discuss them in class. In crafting the presentation and handout-discussion materials think about the *central theme*. What are the main points in the readings? How do they relate to the theme of the class [urban sustainability] and the theme of the week and previous/future weeks? You will need to

critically evaluate these readings, by carefully assessing the ideas proposed, arguments made, and methods proposed. What questions remain unanswered and what ideas need further clarification? Additional guidance on developing effective discussion sessions will be provided in class.

Reading Responses

Over the course of the semester, you are required to submit five 'reading responses.' These two-to-four page responses are an opportunity for you to thoughtfully evaluate academic work in written form. These responses are designed to help you hone your critical thinking and writing skills and to generate material for your final term papers. I am also very interested in your perspectives about the various readings and topics. You have freedom to select readings that are of particular interest to you, analyzing one or two in depth or synthesizing a larger number of them. These are graded as credit/no credit and are designed to be low-pressure writing exercises that stimulate your creative juices. Have fun with them! But please do not take this flexibility as an excuse to submit work that is sloppy and uninspired. I do reserve the right to have you resubmit inferior response papers. Response paper due dates: September 22, October 6, October 20, November 3, and November 17. Please submit by Ctools and by hard copy in class.

Research Paper

The major deliverable for the course is a 6,000-8,000 word research paper that you will write with another student over the course of the semester. You may also elect to write one alone if you prefer. You have freedom to select a research topic that interests you; it just needs to be aligned with the subject matter of the course and should focus on some dimension of urban political ecology, industrial ecology, or urban ecology/planning, or some combination of these thought traditions. The format of the research paper is as a journal article to be hypothetically submitted to an academic journal of your choice. This requires that you follow the author guidelines of the journal, including structure (e.g. introduction, literature review, material/methods, results, discussion, conclusion, references, tables, figures) and style (e.g. reference format, etc.). These author guidelines are readily available on the websites of the various journals. As this is an interdisciplinary course, you are free to select a journal that most closely aligns with your research interests and/or disciplinary orientation. Some journals you may want to consider include the *Journal of Industrial Ecology*, *Annals of the Association of American Geographers*, *Landscape and Urban Planning*, *Journal of the American Planning Association*, *Environmental Science and Technology* and *Geoforum*.

To ensure that you generate a quality product, the term paper assignment is divided into four deliverables due over the course of the semester.

1. Research Proposal (2 – 5 pages) – Due Wednesday, October 15th (Ctools and in my Dana mailbox). This research proposal should include the following components:

- a. Identify an interesting problem or question re. urban sustainability that is connected to the themes and concepts of the course.

- b. Provide an initial outline, structured along the guidelines of the journal that you select.
- c. Provide a list of references that you plan to use.
- d. Include preliminary diagrams or figures as needed.

2. First Draft of Paper – Peer Review (to reviewers) – Due Monday, November 24th by class.

This peer review exercise will help you improve the content, structure, and overall argument of the term paper. You are each responsible for reviewing two papers. An instruction sheet for how to conduct this review will be provided in class. This peer review exercise is double-blind (you do not know who wrote the paper and they do not know who is reviewing it). These peer review comments are due Monday, December 1 by the beginning of class.

With respect to completing a full draft of your paper, please keep the following in mind:

- a) The research question and main claim/thesis/argument should be easy to identify
- b) Evidence should be used to support your claims
- c) Methods used should be clearly articulated
- d) Paper should adhere to the standards described in the author guidelines of the journal of your choice.

3. In-Class Presentation of Research Findings – Due Monday, December 8

For the final class, you will present your major research findings and field questions. The presentation should be 5 minutes long, followed by 5 minutes of Q&A. You may use PowerPoint if you wish.

4. Revised Final Paper - Due Friday, December 12, end of day. Upload on Ctools

This final paper includes revisions stemming from the peer review process.

Grading

- Course Participation (20%)
- Discussion Leadership (20%)
- Reading Responses (5 total) – (15%)
- Research Proposal (5%)
- Peer Review of Research Paper (10%)
- Final Paper (25%)
- Research Presentation (5%)

Final grades are based on the total percentage received for the semester. Equivalent letter grades are as follows: A+ (98.50%-100%), A (93.5-98.49%), A- (89.50 – 93.49%), B+ (87.50-89.49%), B (83.5-88.49%), B- (79.50 – 83.49%), C+ (77.50-79.49%), C (73.5-78.49%), and C- (69.50 – 73.49%).

Writing Help

A primary objective of this course is to develop your writing skills. You may find it helpful to contact the Sweetland Writing Center which offers free individual writing conferences for graduate students who are working on course papers, as well as dissertations, etc. Helpful research and writing aids include: *The Elements of Style* (Strunk and White); *The Craft of Research* (Booth, Colomb, and Williams); *A Manual for Writers of Research Papers, Theses, and Dissertations* (Turabian). Online sources with useful guidance on writing include OWL on-line writing lab from Purdue University (<https://owl.english.purdue.edu/>) and the University of Wisconsin writing handbook (<http://writing.wisc.edu/Handbook/>)

Accommodations for Students with Disabilities

Please contact me during the first week of class so that your needs can be accommodated. You may also wish to contact Services for Students with Disabilities (G-664 Haven Hall, 505 South State St.: 734-763-3000, <http://ssd.umich.edu>).

Academic Integrity

The University of Michigan seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. Plagiarism will not be tolerated and there will be severe consequences. For more information, please see <http://www.rackham.umich.edu/current-students/policies/academic-policies/section10>

READING LIST

(NOTE: THIS LIST MAY CHANGE SLIGHTLY OVER THE TERM. I WILL GIVE YOU AMPLE ADVANCE NOTICE SHOULD SUCH CHANGES OCCUR)

PART I URBAN METABOLISM: CONCEPTS AND APPROACHES

Week 1: Course Overview and What is Urban Sustainability?

Monday, Sep 8

Required Readings

Cronon, W. (2009). *Nature's metropolis: Chicago and the Great West*. WW Norton & Company. (Preface: pp. xv- xxv and Prologue: pp. 5-19)

Wolch, J. (2007). Green urban worlds. *Annals of the Association of American Geographers*, 97(2), 373-384.

Supplemental

Campbell, S. (1996). Green cities, growing cities, just cities?: Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association*, 62(3), 296-312.

McGranahan, G., & Satterthwaite, D. (2003). Urban centers: an assessment of sustainability. *Annual Review of Environment and Resources*, 28(1), 243-274.

Week 2: Urban Metabolism I: Urban Political Ecology

Monday, Sep 15

Required Readings

Heynen, N., Kaika, M., & Swyngedouw, E. (2006). Urban political ecology: politicizing the production of urban natures. In N. Heynen, M. Kaika & E. Swyngedouw (Eds.), *In the nature of cities: urban political ecology and the politics of urban metabolism* (pp. 1-20). Routledge.

Swyngedouw, E. (2006). Metabolic urbanization: the making of cyborg cities. In N. Heynen, M. Kaika & E. Swyngedouw (Eds.), *In the nature of cities: urban political ecology and the politics of urban metabolism* (pp. 21-40). Routledge.

Keil, R. and Boudreau, J. (2006). Metropolis and metabolics: rolling out environmentalism in Toronto. In N. Heynen, M. Kaika & E. Swyngedouw (Eds.), *In the nature of cities: urban political ecology and the politics of urban metabolism* (pp. 41-62). Routledge.

Rubin, H. J., & Rubin, I. S. (2005). *Qualitative interviewing: The art of hearing data*. Sage Publications. (Ch. 2: Why we do what we do: Philosophy of Qualitative Interviewing: pp. 19-38)

Supplemental

Cook, I. R., & Swyngedouw, E. (2012). Cities, social cohesion and the environment: towards a future research agenda. *Urban studies*, 49(9), 1959-1979.

Walker, R. A. (2001). California's golden road to riches: natural resources and regional capitalism, 1848–1940. *Annals of the Association of American Geographers*, 91(1), 167-199.

Gibbs, D., & Deutz, P. (2005). Implementing industrial ecology? Planning for eco-industrial parks in the USA. *Geoforum*, 36(4), 452-464.

Week 4: Urban Metabolism II: Industrial Ecology

Monday, Sep 22

Required Readings

Bai, X. (2007). Industrial ecology and the global impacts of cities. *Journal of Industrial Ecology*, 11(2), 1-6.

Brunner, P. H. (2007). Reshaping urban metabolism. *Journal of Industrial Ecology*, 11(2), 11-13.

Kennedy, C., Cuddihy, J., & Engel-Yan, J. (2007). The changing metabolism of cities. *Journal of Industrial Ecology*, 11(2), 43-59.

Kennedy, C., Baker, L., & Brattebø, H. (2014). Analyzing a city's metabolism. In D. A. Manzmanian & H. Blanco (Eds.), *Elgar Companion to Sustainable Cities: Strategies, Methods and Outlook* (pp. 255-282). Edward Elgar Publishing.

Supplemental

Goldstein, B., Birkved, M., Quitzau, M. B., & Hauschild, M. (2013). Quantification of urban metabolism through coupling with the life cycle assessment framework: concept development and case study. *Environmental Research Letters*, 8(3), 035024.

Kennedy, C., Pincetl, S., & Bunje, P. (2011). The study of urban metabolism and its applications to urban planning and design. *Environmental pollution*, 159(8), 1965-1973.

Andrews, C. J. (1999). Putting industrial ecology into place evolving roles for planners. *Journal of the American Planning Association*, 65(4), 364-375.

Graedel T.E. and Allenby B.R. (1995). *Industrial Ecology*. Prentice Hall. (Ch. 1: Introduction: pp. 2-10, Ch. 2: Overview of the industrial ecology intellectual framework: pp. 11-16, Ch. 3: Sustainable development: pp. 17-39, Ch. 4: Industrial ecology: pp. 40-62)

Leach, M. A., Bauen, A., & Lucas, N. J. (1997). A systems approach to materials flow in sustainable cities: a case study of paper. *Journal of Environmental Planning and Management*, 40(6), 705-724.

Hendrickson, C. T., Lave, L. B., & Matthews, H. S. (2006). *Environmental life cycle assessment of goods and services: An input-output approach*. Routledge. (Ch. 1: Exploring environmental impacts and sustainability through life cycle assessment: pp. 3-20 and Ch. 16: Development of regional economic input-output life cycle assessment models: pp.160-168).

Week 5: Urban Metabolism III: Urban Ecology and Planning

Monday, Sep 29

Required Readings

Golubiewski, N. (2012). Is there a metabolism of an urban ecosystem? An ecological critique. *Ambio*, 41(7), 751-764.

Alberti, M., Marzluff, J. M., Shulenberger, E., Bradley, G., Ryan, C., & Zumbrunnen, C. (2003). Integrating humans into ecology: opportunities and challenges for studying urban ecosystems. *BioScience*, 53(12), 1169-1179.

Grimm, N. B., Faeth, S. H., Golubiewski, N. E., Redman, C. L., Wu, J., Bai, X., & Briggs, J. M. (2008). Global change and the ecology of cities. *Science*, 319(5864), 756-760.

Batty, M. (2008). The size, scale, and shape of cities. *Science*, 319(5864), 769-771.

Supplemental

Folke, C., Å. Jansson, J. Larsson and R. Costanza. (1997). Ecosystem Appropriation by Cities. *Ambio* 26:167-172.

Jones, P., Williams, J., & Lannon, S. (2000). Planning for a sustainable city: an energy and environmental prediction model. *Journal of Environmental Planning and Management*, 43(6), 855-872.

Michael Hough. 1995. *Cities and natural process*. Routledge. (Ch. 2: Water: pp. 33-96, Ch. 3: Plants: pp. 97-164)

PART II URBAN RESOURCE FLOWS AND FORM: OBJECTS OF STUDY

Week 6: Urban Infrastructure: Detroit Site Visit: Ford Factory Tour

Monday, Oct 6

Required Readings

Detroit Future City. (2012). Executive summary and City Systems Section. In Detroit Strategic Framework Plan. Detroit, MI: Inland Press.

Newman, P. (2014). Rediscovering compact cities for sustainability. In D. A. Manzmanian & H. Blanco (Eds.), *Elgar Companion to Sustainable Cities: Strategies, Methods and Outlook* (pp. 15-31). Edward Elgar Publishing.

Gallagher, J. (2010). *Reimagining Detroit: Opportunities for redefining an American city*. Wayne State University Press. (Ch. 2: *Detroit today: pp. 21-38 and Ch. 4: Road diets and roundabouts: pp.73-83*)

Ford Factory Tour. Peruse <http://www.thehenryford.org/rouge/index.aspx>

Supplemental

Gillham, O. (2002). *The limitless city: a primer on the urban sprawl debate*. Island Press. (Chapter 1)

Gordon, P., & Richardson, H. W. (2001). The sprawl debate: Let markets plan. *Publius: The Journal of Federalism*, 31(3), 131-149.

Robinson, L., Newell, J. P., & Marzluff, J. M. (2005). Twenty-five years of sprawl in the Seattle region: growth management responses and implications for conservation. *Landscape and Urban planning*, 71(1), 51-72.

Burchell, R. W., & Mukherji, S. (2003). Conventional development versus managed growth: the costs of sprawl. *American Journal of Public Health*, 93(9), 1534-1540.

Week 7: No Class

Monday, Oct 13

No Required Reading

Week 8: Water

Monday, October 20

Required Readings

Barles, S. (2007). Urban metabolism and river systems: an historical perspective—Paris and the Seine, 1790–1970. *Hydrology and Earth System Sciences*, 4(3), 1845-1878.

Gandy, M. (2004). Rethinking urban metabolism: water, space and the modern city. *City*, 8(3), 363-379.

Supplemental

Oliver, S. (2006). The desire to metabolize nature: Edward Loveden Loveden, William Vanderstegen, and the disciplining of the river Thames. In N. Heynen, M. Kaika & E. Swyngedouw (Eds.), *In the nature of cities: urban political ecology and the politics of urban metabolism* (pp. 93-109). Routledge.

Kaika, M. (2006). The political ecology of water scarcity: the 1989-1991 Athenian drought. In N. Heynen, M. Kaika & E. Swyngedouw (Eds.), *In the nature of cities: urban political ecology and the politics of urban metabolism* (pp. 157-172). Routledge.

Week 9: Food: Detroit Site Visit: Detroit Future City

Monday, October 27

Required Readings

McClintock, N. (2010). Why farm the city? Theorizing urban agriculture through a lens of metabolic rift. *Cambridge Journal of Regions, Economy and Society*.

Gallagher, J. (2010). *Reimagining Detroit: Opportunities for redefining an American city*. Wayne State University Press. (Ch. 3: Potential and problems in urban agriculture: pp. 39-72)

Detroit Future City. (2012). Land use section. In Detroit Strategic Framework Plan. Detroit, MI: Inland Press. (Skim)

Supplemental

Heynen, N. (2006). Justice of eating in the city: the political ecology of urban hunger. In N. Heynen, M. Kaika & E. Swyngedovw (Eds.), *In the nature of cities: urban political ecology and the politics of urban metabolism*. (pp. 129-142). Routledge.

Week 10: Food II and Green Space

Monday, November 3

Required Readings

Cronon, W. (2009). *Nature's metropolis: Chicago and the Great West*. WW Norton & Company. (Ch. 3 Pricing the future: Grain: pp. 97-147)

Heynen, N., Perkins, H. A., & Roy, P. (2006). The political ecology of uneven urban green space the impact of political economy on race and ethnicity in producing environmental inequality in Milwaukee. *Urban Affairs Review*, 42(1), 3-25.

Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and Urban Planning*, 125, 234-244.

Gallagher, J. (2010). *Reimagining Detroit: Opportunities for redefining an American city*. Wayne State University Press. (Ch. 5: Healing a wounded landscape: pp. 85-96 and Ch. 6: Filling the vacancy: pp. 97-117)

Supplemental

Robbins, P., & Sharp, J. T. (2008). Producing and consuming chemicals: the moral economy of the american lawn. In *Urban Ecology* (pp. 181-205). Springer US.

Jennifer Wolch. (1996). Zoopolis, *Capitalism, Nature, Socialism*. 7: 21-48.

McKinney, M. L. (2002). Urbanization, Biodiversity, and Conservation. *BioScience*, 52(10), 883-890.

Week 11: Buildings and Energy

Monday, November 10

Required Readings

Baynes, T. M., & Bai, X. (2012). Reconstructing the Energy History of a City. *Journal of Industrial Ecology*, 16(6), 862-874.

Kennedy, C., Steinberger, J., Gasson, B., Hansen, Y., Hillman, T., Havranek, M., & Mendez, G. V. (2009). Greenhouse gas emissions from global cities. *Environmental Science & Technology*, 43(19), 7297-7302.

Carlson, Jill, Jenny Cooper, Marie Donahue, Max Neale, and Anis Ragland. (August 2014) *City of Detroit Greenhouse Gas Inventory: An Analysis of Citywide and Municipal Emissions for 2011 and 2012. Final Report*. University of Michigan Center for Sustainable Systems, School of Natural Resources and Environment. Read Executive Summary.

Rees, W. E. (2009). The ecological crisis and self-delusion: implications for the building sector. *Building Research & Information*, 37(3), 300-311.

Supplemental

Christen, A., Coops, N. C., Kellett, R., Crawford, B., Heyman, E., Olchovski, I., ... & van der Laan, M. T. (2010). A LiDAR-based urban metabolism approach to neighbourhood scale energy and carbon emissions modelling.

Wheeler, S. M., & Beatley, T. (Eds.). (2004). *The sustainable urban development reader*. Psychology Press. (Reading from Peter Calthorpe, and Section on Transportation, pp. 87-110, Section of Green Architecture and Building, pp. 179-198, and Case Studies of Sustainability at the Building and Site Scale, at the Neighborhood or District Scale, and at the City and Regional Scale, pp. 297-316).

Week 12: Waste and Justice

Monday, November 17

Required Readings

Cronon, W. (2009). *Nature's metropolis: Chicago and the Great West*. WW Norton & Company. (Ch. 5 Pricing the future: Grain: pp. 207-259)

Marvin, S., & Medd, W. (2006). Metabolisms of obesity: flows of fat through bodies, cities, and sewers. *Environment and Planning A*, 38(2), 313.

Clapp, J. (2002). The distancing of waste: Overconsumption in a global economy. *Confronting consumption*, 155-176.

Chertow, M. R. (1998). Waste, industrial ecology, and sustainability. *Social Research*, 31-53.

Supplemental

Njeru, J. (2006). The urban political ecology of plastic bag waste problem in Nairobi, Kenya. *Geoforum*, 37(6), 1046-1058.

Princen, T. (2001). Consumption and its externalities: where economy meets ecology. *Global Environmental Politics*, 1(3), 11-30.

PART III TOWARDS AN INTEGRATIVE APPROACH FOR A SUSTAINABLE URBAN METABOLISM

Week 13: Indicators of Urban Sustainability

Monday, November 24

Required Readings

Bell, S., & Morse, S. (2008). *Sustainability indicators: measuring the immeasurable?* Earthscan. (Ch.1: Sustainability and sustainability indicators: pp. 3-44)

Portney, K. E. (2014). Developing sustainable cities indicators. In D. A. Manzmanian & H. Blanco (Eds.), *Elgar Companion to Sustainable Cities: Strategies, Methods and Outlook* (pp. 283-301). Edward Elgar Publishing.

Newman, P. W. (1999). Sustainability and cities: extending the metabolism model. *Landscape and urban planning*, 44(4), 219-226.

Supplemental

McManus, P. (2005). *Vortex cities to sustainable cities: Australia's urban challenge*. UNSW Press. (Ch. 4: Toward sustainable cities, pp. 70-88)

Shane, A. M., & Graedel, T. E. (2000). Urban environmental sustainability metrics: a provisional set. *Journal of Environmental Planning and management*, 43(5), 643-663.

Bertone, G., Parry, S. C., Kubani, D., & Wolch, J. (2006). Indicators in action: the use of sustainability indicators in the City of Santa Monica. In *Community Quality-of-Life Indicators* (pp. 43-60). Springer Netherlands.

Holden, M. (2006). Sustainable Seattle: The case of the prototype sustainability indicators project. In *Community Quality-of-Life Indicators* (pp. 177-201). Springer Netherlands.

Bullen, A., & Whitehead, M. (2005). Negotiating the networks of space, time and substance: a geographical perspective on the sustainable citizen. *Citizenship studies*, 9(5), 499-516.

Week 14: Towards Synthesis? Integrative Approaches to Urban Metabolism

Monday, December 1

Required Readings

Cronon, W. (2009). *Nature's metropolis: Chicago and the Great West*. WW Norton & Company. (Epilogue, 371-385)

Broto, V. C., Allen, A., & Rapoport, E. (2012). Interdisciplinary perspectives on urban metabolism. *Journal of Industrial Ecology*, 16(6), 851-861.

Newell, J. P., and Cousins, J. (2014). The Boundaries of Urban Metabolism. In Review.

Pincetl, S., Bunje, P., & Holmes, T. (2012). An expanded urban metabolism method: Toward a systems approach for assessing urban energy processes and causes. *Landscape and Urban Planning*, 107(3), 193-202.

Supplemental

Barles, S. (2010). Society, energy and materials: the contribution of urban metabolism studies to sustainable urban development issues. *Journal of Environmental Planning and Management*, 53(4), 439-455.

Week 15: Final Presentations

Monday, December 8

No Required Reading

NRE 501 (URBAN SUSTAINABILITY) MAJOR COURSE DELIVERABLES

<i>Deliverables</i>	<i>Due Date</i>	<i>Delivery Method</i>
<i>Reading Response #1</i>	<i>Monday, September 22</i>	<i>Ctools; hard copy in class</i>
<i>Reading Response #2</i>	<i>Monday, October 6</i>	<i>Ctools; hard copy in class</i>
<i>Research Proposal</i>	<i>Wednesday, October 15</i>	<i>Ctools; hard copy in class</i>
<i>Reading Response #3</i>	<i>Monday, October 20</i>	<i>Ctools; hard copy in class</i>
<i>Reading Response #4</i>	<i>Monday, November 3</i>	<i>Ctools; hard copy in class</i>
<i>Reading Response #5</i>	<i>Monday, November 17</i>	<i>Ctools; hard copy in class</i>
<i>Paper Drafts for Peer Review</i>	<i>Monday, November 24</i>	<i>Ctools</i>
<i>Peer Review Comments</i>	<i>Monday, December 1</i>	<i>Ctools</i>
<i>Final Presentations</i>	<i>Monday, December 8</i>	<i>In-Class presentations</i>
<i>Final Papers</i>	<i>Friday, December 12</i>	<i>Ctools</i>