Teaching Unit Number 4 - Downwind, Downstream, Downtown: Ecological Footprint Analysis.

Network in Canadian History and Environment (NiCHE) - Environmental History
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This university-level teaching unit is designed to be easily scaled up or down regarding class time consumed, or difficulty, as appropriate for the individual course context. The material in this unit has a comparative focus on Canada and the United States (specifically Montréal and Baltimore), though instructors in other locations are encouraged to improvise on their own, using this module as a base, to extend the comparative element or to make connections to other places or themes.

Learning goals.
- Introduce the theme of ecological footprint analysis as a means to structure historical narrative
- Contextualize the production of urban waste
- Familiarize the student with archival sources that inform urban historical geography
- Encourage students to connect these concepts with their own experience of the world

This teaching unit is composed of five resources:
- An open source journal article, to be assigned as a reading
- Discussion questions focused on the reading
- A contextual essay, around which instructors can build their own lectures, or share with Teaching Assistants working outside of their area of expertise
- Primary sources, to be deployed as best suits the purposes of the instructor
- A glossary of terms and concepts critical to understanding the article

Resources:

2) Article Discussion Questions
Q. What is the “urban funnel,” and how does it relate to material flows? Look to the Montréal and Baltimore case studies to illustrate your response. Consider the evolution of its shape over time.
Q. Why does Olson argue the importance of monitoring the scale and speed of urban growth? How might her research focus be useful to city planners?

Q. What is path dependence? While Olson understands Montreal and Baltimore to have undergone similar construction trends, she emphasizes how the cities’ decisions necessarily diverged in cases of ecological difference. What are some of the positive and negative ways in which these unique aspects of the cities influenced their respective growth? Could the outcomes have been otherwise?

Q. Olson scrutinizes industry for its potential to affect far greater material flows than any other actor, and hence, to introduce far greater contaminants into public space. She suggests that government has the power to intervene in industrial practices, and to curtail environmental damage. Knowing what you do now, what policy recommendations would you propose to regulate dumping by industry in your home jurisdiction?

Q. Olson contests the validity of data collected on the ecological footprints of cities. On what grounds does she challenge the accuracy, and what other sorts of considerations does she propose must be taken into account?

Q. Olson presents an unpleasant side to construction booms, acknowledging that “surges of construction” are also “surges of discard.” What are the environmental costs of construction and industry? Who assumes this burden, and who reaps the rewards? Discuss this question as it pertains to the idea of environmental justice.

3) Contextual essay
In her article, historical geographer Sherry Olson constructs a comparative study of Montréal and Baltimore, using diverse quantitative sources. In forging her case, Olson makes heavy use of several distinct themes within the broad ecological economics literature. Specifically, she draws upon the ideas of ecological footprint analysis, ecological services and path dependence. Olson argues that urban infrastructural decisions have significant environmental implications long after first implementation.

Students must understand these theoretical underpinnings of Olson’s article to truly appreciate the argument. While many will already be familiar with the general shape of Ecological Footprint analysis, fewer will have encountered ecological services or path dependence. Instructors may want to use the following information in a lecture as a way to make the reading more meaningful for students.

“Over-population”
For several centuries, concerns about population, or more precisely overpopulation, drove debates about how states and societies ought to intervene in the lives of private persons. For instance, did the state have an obligation to look after the poor? What was the relationship between poverty and population numbers? Significant personalities to include in a lecture might be Reverend Thomas Robert Malthus (1766-1834) and a long
possible list of more contemporary neo-Malthusians such as Paul and Anne Ehrlich (authors of *The Population Bomb*), Garret Hardin (modern popularizer of the “Tragedy of the Commons”), the Club of Rome, and Lester Brown (president of the Worldwatch Institute). Much of this twentieth century literature aimed to predict when exponential population growth would result in famine and resource scarcity (and, more importantly, the resulting social chaos). However, despite best attempts in their formulation, none of these predicted apocalypses ever came to pass. This begged the question, were the predictions unfounded, or were those making them simply wrong about their timing?

**Ecological Footprint Analysis**

Through the 1970s and 1980s, environmentally minded scholars and pundits became increasingly receptive to viewing poverty as a cause of high population growth rates and environmental destruction. The 1987 Brundtland Commission report *Our Common Future* is the culmination of these ideas. The report highlighted the needs of the world’s poor with respect to environmental sustainability. In the years since the early 1990s, the prior fixation with absolute population numbers as a cause for theorized resource exhaustion, has given way to a different driving force: the unequal distribution of consumption and wastes. Put in another way, a very few rich individuals wreck the greatest environmental destruction, while the overwhelming majority of the world’s poor lead much more environmentally benign lives. The most well known manifestation of this per capita mode of understanding inequity and differential environmental impacts is Ecological Footprint analysis.

Scholarly experience indicated that it was impossible to determine when food and resource scarcity would instigate global mass death and chaos. It was surely much more productive to flip that equation upside-down. University of British Columbia planner and ecological economist William Rees and his PhD student Mathis Wackernagel developed a method to estimate how large an area of productive land was required to support the existing inhabitants of a single city. They did this using a thought experiment to illustrate that the geographic locations of cities no longer coincide with their ecological locations.

Imagine a city with a large dome over it, impermeable but elastic; how large would that dome have to be to support the urban inhabitants with resources and the assimilative capacity to absorb their wastes? This idea can be further expanded to include all cities. How many earths would be required to satisfy particular rates of consumption over the long term? This is a significant shift in outlook with a profound impact on the shape of subsequent historical narratives. Olson’s article is one such example of what might be done using ecological footprint analysis as an historical organizing tool.

**Ecosystem Services**

In writing her article, Olson also enlists ideas from the “ecosystem services” literature, a second parallel sub-body of the broader field of ecological economics. The term “ecosystem services” focuses on links between non-human ecosystems and the human economy. It is premised on the idea that current rates of resource harvesting and waste generation deplete nature faster than it can regenerate. This literature originated in the
late 1970s and 1980s as a way to encourage the lay public to view the beneficial functions of ecosystems in a new utilitarian light, and thus increase support for biodiversity conservation.

One slightly later definition comes from Costanza et al.:

Ecosystem functions refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions. For simplicity, we will refer to ecosystem goods and services together as ecosystem services.¹

A second oft-cited definition comes from Gretchen Dailey:

Ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life. They maintain biodiversity and the production of ecosystem goods, such as seafood, forage, timber, biomass fuels, natural fiber, and many pharmaceuticals, industrial products, and their precursors. The harvest and trade of these goods represent an important and familiar part of the human economy. In addition to the production of goods, ecosystem services are the actual life-support functions, such as cleansing, recycling, and renewal, and they confer many intangible aesthetic and cultural benefits as well.²

This interpretation of ecosystems as service providers entered the mainstream literature in the 1990s when Costanza et al explored ways of assigning dollar values to ecological functions. This concept was further popularized by the Millennium Ecosystem Assessment (MA) in the early 2000s, which launched these ideas into public policy practice.

Despite any nuances, all definitions of ecosystem services highlight their characteristics as public goods and how they can support the creation of private goods. The current interest in the protection of ecosystems and their services reflects the belief among many people that ecosystems are being overexploited in the production of private goods and that these private goods should be produced in such a way as to maintain the existing stock of ecosystem capital.³

³ Neal Allan MacDougall, "The Tradeoff between Ecosystem Services and Location of Production: The Case of Shrimp Aquaculture in an Ecuadorian Mangrove Ecosystem" (University of California, Berkeley: PhD Dissertation, 1999).
Path Dependence. Prior decisions constrain future ones, even if the original circumstances are no longer relevant. Path dependence is a term popularized in the mid 1980s by economic historian Paul A. David. Path dependence is a property of a system such that the outcome over a period of time is not determined by any particular set of initial conditions. Rather, a system that exhibits path dependency is one in which outcomes are related stochastically [or randomly] to initial conditions, and the particular outcome that obtains in any given ‘run’ of the system depends on the choices or outcomes of intermediate events between the initial conditions and the outcome.4

Given the nuanced complexities involved, an example will be helpful. The classic illustration of path dependent system is that of a Polya urn experiment.

“Imagine an urn with four balls in it—one red, one yellow, one white, and one black. The object is to fill the urn by selecting one ball and then replacing it along with two more balls of whichever color is chosen. Which color will dominate the full urn’s contents? Note that whichever ball is drawn first—red, yellow, white, or black--will gain an advantage in future rounds, for there will then be three of that color, and only one of each of the others. Therefore, 50% of the time, the first color chosen then will also be chosen second, thus receiving an even larger advantage. Nonetheless, this does not mean that the first color drawn will always fill the urn. There is a 50% chance that another color will be drawn on the second round, thus restoring parity between at least two colors, and leaving it to later choice to tip the balance in any one color’s favor. The study of this class of problems has shown that there is no determinate outcome; rather the final pattern depends on the particular choices that happen to be made in the sequence of filling the urn.”5

Of course human decisions through time are not random. The experiment example is useful to highlight the cumulative importance of even seemingly small decisions on later outcomes.

The themes as united in the article. The urban funnel model describes a way of thinking about resource appropriation and waste disposal, by the city, that is sensitive to the spatial distribution of these activities.6

5 Goldstone, 834.
6 Luck et al, “The Urban Funnel Model and the Spatially Heterogeneous Ecological
As described in the article, initially most bulky commodities were acquired close to home, with only very high value goods coming from afar. With time came decreased shipping costs, allowing for longer journeys of lower value goods. Throughout the period, however, waste disposal continued in situ. Each surge in urban growth in the two cities produced a corresponding leap in size and complexity of the urban funnel; each surge also established a future stream of demands for ecosystem services.

4) Primary Sources

**Montreal**

Transportation
Il-116749, Unloading S.S "Durham City", Montreal, QC, 1896

VIEW-2230, Harbour from examining warehouse, Montreal, QC, about 1890

MP-1994.1.2.1061, Mayor Jean Drapeau and Lucien Saulnier, as the first Metro train passes (1966).

Energy
VIEW-4941.1, Coal towers, Montreal harbour, QC, about 1912

A chronology of Hydro-Québec
<http://www.hydroquebec.com/about-hydro-quebec/who-are-we/history-hydro-quebec.html>

Sewage/waste
M979.87.360, The Hochelaga Cotton Factory
<http://www.mccord-museum.qc.ca/en/collection/artifacts/M979.87.360>

VIEW-2943, Montreal from Street Railway Power House chimney, QC, 1896

A History of Problems. Out of sight, out of mind. Montreal’s long and troubled history involving sewage treatment and water pollution issues
<http://www.undermontreal.com/montreal-wastewater-treatment-plant/>

Same/similar content:

Construction/Deconstruction
MP-0000.1297.1, Group of workmen, demolition of buildings on University Street, Montreal, QC, about 1910, About 1910, 20th century.
<http://www.mccord-museum.qc.ca/en/collection/artifacts/MP-0000.1297.1>

Maps
Map of Montreal and area, 1744.

City of Montreal, 1888.

**Baltimore.**
The Baltimore County Public Library has a searchable collection of digitized archival photographs. <http://catalog.bcpl.lib.md.us/polaris/> The URLs it produces are temporary, but here are a few image suggestions.

Streetcar from Baltimore, Pimlico and Pikesville line of Baltimore Traction Company, 1890s.
Pratt and Light Streets, Baltimore, 1904
A Baltimore Gas & Electric Company excavator is digging a trench for the laying of gas pipe in the Lansdowne area, 1928.
Hollingworth's Dam over the Jones Falls, year unknown.

Transportation
Maryland Department of Transportation.
While not organized chronologically, this webpage gives a good summary of related events for this district.

Energy
Baltimore Gas and Electric historical slideshow.

Waste
Conservation. Scrap iron and steel, Baltimore, 1941.
<http://hdl.loc.gov/loc.pnp/fsa.8e10685>

Baltimore, Md., from Federal Hall [i.e. Hill], 1900.
<http://hdl.loc.gov/loc.pnp/det.4a10949>

History of the Baltimore Sewer System
5) Glossary

The “treadmill of destruction” (p. 860): This is an example of scholarly wordplay. In a short, compact phrase, Olson is communicating a very complex set of ideas. Here, she plays off the phrase “the treadmill of production” coined by Allan Schnaiberg in his book from 1980, The Environment: From Surplus to Scarcity. Much more recently Hooks and Smith used the phrase to describe the inflexible and unyielding expansion of capitalism and the negative consequences of this expansion for the environment (Hooks and Smith, 2005, “Treadmills of Production and Destruction: Threats to the Environment Posed by Militarism”). However, Hooks and Smith extend Schnaiberg’s original idea, in that they also argue that there is a second treadmill. The “treadmill of destruction” draws attention to a distinct expansionary dynamic that also generates additions to and withdrawals from the environment. However, the treadmill of destruction refers specifically to expansionary dynamics associated with war and militarism: geo-political competition and arms races. This is the sense that Olson uses the phrase in our current reading. City expansion (and thus the environmental effects of city-building) may have slowed down in both Montreal and Baltimore during the Second World War. Olson is making the point that environmental destruction was redirected away from the city and into the war effort.

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