

**The Olympia Brewing Company 1896-1916:
A Case Study in Environmental History and
Life Cycle Assessment**

by

Nathan John Nadenicek

A Thesis
Submitted in partial fulfillment
of the requirements for the degree
Master of Environmental Studies
The Evergreen State College
June 2015

©2015 by Nathan John Nadenicek. All rights reserved.

This Thesis for the Master of Environmental Studies Degree

by

Nathan John Nadenicek

has been approved for

The Evergreen State College

by

Kevin Francis, Ph.D.
Member of the Faculty

Date

ABSTRACT

The Olympia Brewing Company 1896-1916: A Case Study in Environmental History and Life Cycle Assessment

Nathan John Nadenicek

The Olympia Brewing Company—located in Tumwater, Washington—grew substantially from its founding in 1896 until the time that prohibition was enacted in Washington in 1916. During this time the brewery grew to become a large regional industry with supply and distribution chains that extended nationally and even globally. For this thesis, I examined the environmental impact of the Olympia Brewing Company during these formative years, using the tools of life cycle analysis and environmental history. From the archives of the Olympia Brewing Company, along with other historical resources, I collected a large amount of qualitative and quantitative information. The indicator for this study was acres of land used to grow the barley and hops. This land use was compared in the month of October in the years 1900 and 1910. Land use was compared at the barrel level for selected batches of lager and bock beers along the timeline of this study. I found that while the amount of land use grew significantly as the company expanded, the amount of land use per barrel changed only slightly between these years. Changing agricultural practices was identified as a possible cause of the variations in per barrel land use throughout the years. This study contributes to local environmental history of this area and begins a conversation about how these two methods of understanding environmental impact can be integrated.

Table of Contents

List of Figures.....	vii
List of Tables.....	vii
Acknowledgments.....	ix
The Olympia Brewing Company Brewhouse Built 1906.....	x
Chapter 1: Introduction.	1
Chapter 2: Literature Review.....	5
<u>Environmental History.....</u>	5
Nature and Culture.....	8
Historical and Scientific Method.....	9
Scale in Time and Space.....	12
<u>Environmental History and Historic Breweries.....</u>	15
<u>Life-cycle Assessment.....</u>	16
<u>Life Cycle Assessments about beer and brewing.....</u>	17
<u>Life Cycle Assessment and Environmental History.....</u>	19
Barley.....	20
Hops.....	22

Chapter 3: Brief History of the Olympia Brewing Company.....	24
Chapter 4: Methods.....	26
<u>Historical Research Methods.....</u>	26
<u>The Olympia Brewing Company Archives.....</u>	27
<u>Life Cycle Assessment and Historic Data.....</u>	28
<u>Procedural Guidance.....</u>	29
<u>Goal Definition and Scoping.....</u>	31
<u>Functional Unit.....</u>	32
<u>Raw Materials.....</u>	32
<u>Transportation.....</u>	34
<u>Waste Products and Recyclables.....</u>	35
Chapter 5: Results.....	37
<u>Case study for barley October 1900 compared to October 1910.....</u>	38
Location of Malt Manufacture.....	40
Malt to Barley Conversion.....	40
Land Use Per Acre.....	42
Distance Barley Traveled.....	43

<u>Case Study for Hops October 1903 compared to October 1910</u>	44
Location of Hops Growing Regions.....	45
Amount of Hops Used.....	46
Hops Land Use Per Acre.....	47
Distance Hops Traveled.....	59
<u>Land Use Per Barrel</u>	40
Chapter 6: Discussion	58
<u>Barley and the Olympia Brewing Company</u>	58
<u>Density of Barley Farming</u>	59
<u>Hops and the Olympia Brewing Company</u>	63
<u>Completing The Cycle</u>	64
Chapter 7: Conclusion	65
Bibliography	67

List of Figures

<i>Figure 1. This photo of the Olympia Brewing Company Brewhouse, Located in Tumwater Washington was taken around 1910. Photo: Courtesy of the Olympia Tumwater Foundation.....</i>	<i>x</i>
<i>Figure 2. Olympia Brewing Company Brewhouse 2007. Photo: Nathan Nadenicek.....</i>	<i>x</i>
<i>Figure 3. Spatial temporal overlap areas of history and science</i>	<i>13</i>
<i>Figure 4. Two Row and Six Row Barley.....</i>	<i>21</i>
<i>Figure 5. Phases of LCA.....</i>	<i>30</i>
<i>Figure 6. Sample list of raw materials for beer.....</i>	<i>34</i>
<i>Figure 7. Examples of Accounts Showing Distribution</i>	<i>35</i>
<i>Figure 8. Letterhead from Bauer Schweitzer Hop & Malt Company</i>	<i>39</i>
<i>Figure 9. Letterhead from The Ladish-Stoppenbach Co.....</i>	<i>39</i>
<i>Figure 10. From The Index of The American Brewer's Review</i>	<i>40</i>
<i>Figure 11. Letterhead from Kola Neis, a Hops Broker in Salem, Oregon.....</i>	<i>45</i>
<i>Figure 12. Letterhead from Epstein Mendl and Grube Purveyors of Choice Bohemian Hops.....</i>	<i>46</i>
<i>Figure 13. Barrel Breakdown of Raw Materials Used in 1902</i>	<i>51</i>

List of Tables

<i>Table 1 Total amount of malt used in 1900 compared to 1910.</i>	<i>38</i>
<i>Table 2 Increase from malt to barley in 1900.</i>	<i>41</i>
<i>Table 3 Increase from malt to barley in 1910.</i>	<i>41</i>
<i>Table 4 Acres used to grow barley for beer brewed in October 1900 compared to October 1910.</i>	<i>42</i>
<i>Table 5 linear distances from source of malt to Tumwater Washington.</i>	<i>44</i>
<i>Table 6 Hops used by location in October 1903.</i>	<i>47</i>
<i>Table 7 Hops used by location in October 1910.</i>	<i>47</i>
<i>Table 9 Acres used to grow hops in October 1910.</i>	<i>49</i>
<i>Table 10 Distance from source to Tumwater, WA.</i>	<i>50</i>
<i>Table 11 Lager Brewed on 1900.</i>	<i>52</i>
<i>Table 12 Bock Brewed in 1903.</i>	<i>53</i>
<i>Table 13 Lager Brewed in 1903.</i>	<i>54</i>
<i>Table 14 Bock Brewed in 1907.</i>	<i>55</i>
<i>Table 15. Lager Brewed in 1907.</i>	<i>55</i>
<i>Table 16 Bock Brewed in 1910.</i>	<i>56</i>
<i>Table 17 Lager Brewed in 1910.</i>	<i>57</i>

Acknowledgements

It is a great privilege and honor to have been able to be a student of Evergreen's Graduate Program on the Environment. It has been a long and difficult journey that I most assuredly did not make alone. The completion of this thesis and the Master of Environmental Studies degree would not have been possible without the support, encouragement, nurturing and motivation that I have received from others along the way.

I owe a great debt of gratitude to the students, faculty and staff at The Evergreen State College. My reader Kevin Francis, Ph.D. helped me at each phase of this project from the first phases until the finished product. The faculty of the MES program has helped me each step of the way through many difficulties. The fellow students that I have had the pleasure of learning with were always available for support and camaraderie. I would also like to thank the first person I met at Evergreen, Gail Wooten, who was always there to answer the questions I had even if I didn't know whom to ask.

My thesis research would not have been possible without the cooperation and support of the wonderful people at the Olympia Tumwater Foundation. Thanks to John Freedman who could have turned me away but instead treated me like on of the gang. Karen Johnson and Don Trospen were always available to help me with my research in the Schmidt House archives. Bob Crim and Jose Guzman were never too busy to unlock the door for me.

One of the greatest assets on my side through this part of my life was my family. My wife Jennifer always encouraged me when times got difficult and tolerated all the late nights and grumpy mornings. Mom and dad were always supportive and believed in me. In addition to helping me through this program and this thesis with motivation and knowledgeable advice my dad showed me that most challenges are surmountable. My daughter gives the best encouragement of all when her little voice says "good job daddy".

The Olympia Brewing Company Brewhouse Built in 1906.



Figure 1. This photo of the Olympia Brewing Company Brewhouse, Located in Tumwater Washington was taken around 1910. Photo: Courtesy of the Olympia Tumwater Foundation.



Figure 2. Olympia Brewing Company Brewhouse 2007. Photo: Nathan Nadenicek

Chapter 1: Introduction

“Every age has a keyhole to which its eye is pasted.”

-- Mary McCarthy, *On the Contrary*

Because today's challenging, even ominous, environmental problems seem so ever present, the backward glance we call history would seem to have little value in providing solutions. What insights could possibly be found in crumbling buildings, dusty books, and sequestered archival collections? While nostalgia may cause a person to venerate assumed nobility in a gaze from an old photo or place blame for our current problems on perceived carelessness or ignorance in the past, it is difficult to imagine any contemporary application for such anachronisms. In truth history's contemporary use is grounded in the fact that it always presents the past through the lenses of current ideas and values as the quotation from Mary McCarthy so clearly expresses. In that way history is not really about the past, but rather a road map replete with markers from the past drawn to guide contemporary travelers. The environmental history lens, then, can be particularly useful in providing ideas and direction to today's environmental dilemmas. As John Opie has written “The environmental historian participates in the gulf between the ecological ideal and historical reality, between the two cultures of science and the humanities”.¹

¹Opie John. “Environmental History: Pitfalls and Opportunities,” *Environmental Review* 7 (1983): 8-16, quotation on page 15

To date there have been no environmental histories written about breweries, which is difficult to explain given the expansive land use and transportation reach of the industry. The intent of this thesis is to present an environmental history and land use impact study of the early years of the Olympia Brewing Company of Tumwater, Washington. It is a common misconception that American breweries distributed their products locally prior to 1920 and that the development of large national beer companies emerged only after the repeal of prohibition in 1933.² In fact, many companies began to dramatically expand their distribution networks prior to prohibition. The period of this research, therefore, will commence with the company's founding in 1896 and finish when prohibition legislation went into effect in Washington State in 1916 (four years before the federal prohibition laws were in place). In conducting this research I employ the methods used by environmental historians in an effort to understand the complex relationship that the Olympia Brewing Company (OBC) had with the local, regional, national and even international landscapes.

In an effort to link the cultures of science and the humanities as John Opie suggests, this environmental history of the OBC will also apply the methods associated with the study of the life cycles of products and industrial practices. To my knowledge this thesis is the first attempt within environmental history to apply life cycle assessment as a major component of the study. The use of life cycle analysis is an effort to study environmental history in a new way, trying to understand the quantities associated with the relationships between the brewery and the landscape.

² Satran, Joe "Craft Beer Growth Pushes Number of Breweries in U.S. Higher than Ever Before" The Huffington Post 12/13/2012. This article discusses the number of breweries falling due to larger ones taking over as a post prohibition occurrence.

Environmental history is a way of assessing and communicating the complex reciprocal relationship between the natural environment and human society in the past.³ The environmental history of the OBC, like that of all American breweries, is far from well understood. While there is a good deal of information about the brewing industry in general and the Olympia Brewing Company in particular for the years I am studying, the material is mostly in the form of biographies, secondary studies, and documentation of business practices rather than environmental impact. Therefore, the purpose of this environmental history is to understand the role that OBC played in the changing landscape, as well as assessing the geographic extent of that change, using the technique of Life Cycle Assessment.

Life Cycle Assessment is a proven method used to study energy inputs and outputs and connected environmental impacts linked to a product throughout its entire life cycle. In other words, Life Cycle Assessment (LCA) is a systems-based approach to quantifying the human health and environmental impacts associated with a product's life from “cradle to grave.”⁴ LCA will provide additional tools beyond an environmental history narrative in order to assess the company’s environmental reach and land use influence.

While there are many possible starting places for this study, such as the geological processes that created the soil or the history of the farming communities that provide the crops, I have chosen to begin by discussing the raw materials that are the ingredients in

³ Oosthoek, Jan, *Environmental History Resources*, www.eh-resources.org. Accessed: November 5, 2014.

⁴ United States Environmental Protection Agency (“Life-Cycle Assessment | Sustainability Analytics | Research | US EPA”) This guide from the EPA provides very detailed guidelines for conducting LCA studies that I used for guidance as I set up my study.

the beer that was brewed by the OBC. I have chosen this place to start because it is within the scope of the LCA and pertinent information is directly available in an archival collection. While there are a large variety of recipes for beer around the world and throughout time, there are four basic ingredients to most beers. Water, grain, hops and yeast can be combined in almost infinite ways to create the desired taste, color and aroma.⁵ As the amount of raw materials used and their origin changed so did the land use of the OBC.

Throughout this document the study of the land use history of the OBC will be conducted. Chapter 2 is a literature review, which examines the relationship between environmental history and Life Cycle Assessment, discussing the gaps in scholarship and opportunities for interdisciplinary research. Chapter 3 provides a brief history of the Olympia Brewing Company. Chapter 4 explains the research methods throughout, discussing types of evidence and guidance. Chapter 5 presents the results of the study of the land use of the OBC. Chapters 6 and 7 provide discussion of the results and concluding statements.

⁵Hoverson, Doug. *Land of Amber Waters the History of Brewing in Minnesota*. Minneapolis: U of Minnesota, 2007.Pg 1

Chapter 2: Literature Review

While there are numerous ways to consider the importance of framing context in environmental research, this study establishes it through a historical analysis.

Environmental history spans large timeframes and cultural contexts and yet can be of great value in addressing the problems and issues that culture faces in today's natural environment. Understanding the different dimensions of environmental history provides contemporary lessons about the same relationships of nature and culture, historic and scientific methods, and relationships of scale found in all types of environmental research. These dimensions help to create a more encompassing historical study by ensuring that as much of the context involved is considered. Life Cycle Assessment aims to encompass as much of the environmental influence of the system being studied by striving to measure the impact of each part of the process. When considering breweries and in particular the OBC in a historical timeframe, I am also considering to what extent environmental history and LCA can be brought together to expand the conversation about these two areas of research and their application to a specific area of local history.

Environmental History

Placing human society within the natural environment, and not in indifference to it, forces the telling of history in a way that emphasizes both human achievements and the natural conditions that provided cultural affordances. While many histories illustrate an indifference to the natural environment (or in some cases in opposition to it) by emphasizing human society as the major actor, environmental histories focus on a

symbiotic relationship. In order to understand why industry and cities are built and prosper in some places and not others historians looked to the relationship with the natural environment. Also in an effort to understand the origins of contemporary environmental problems historians cast an eye to the relationship that was historically nurtured between the people and the places in which they lived and worked. Environmental history draws attention to the fact that human society and nature are intricately intertwined.⁶

One of the best examples of a thought-provoking presentation of the interconnectedness of humans and nature is *Nature's Metropolis: Chicago and The Great West* in which William Cronon tells the story of Chicago in the nineteenth century⁷. The story of the city in no way stops at the city limits but instead reaches far into the hinterland. One particular quality of the book is that it constantly reminds the reader that what seemed to be the vast wilderness of the west was quickly captured into the systems of commodification (a playing field of human and nature interactions) that fueled Chicago's rapid growth. Because of Chicago's location, it became the center for a processing and manufacture system that reached into the nation's vast Midwestern and Western landscapes through new rail systems. In less than a generation the city and its vast network altered the look and lay of the land forever. Innovations such as the refrigerated railroad car allowed the shipping of meat products from the vast stockyards across much of the nation. According to Cronon, *Nature's Metropolis* is the appropriate term for those vast hinterlands because that is where human dynamics became bound to

⁶ Taylor, Bron. "'It's Not All About Us': Reflections On The State Of American Environmental History." *Journal Of American History* 100.1 (2013): 140-144. P144

⁷ Cronon, William. *Nature's Metropolis: Chicago and the Great West*. New York: W.W. Norton, 1991. Print.

economic dynamics and those markets extended the reach of the city into vastness of the new nation. William Cronon's book is a good example of an environmental history that shows how industry may reach well beyond its physical location and directly influence landscape changes on a large scale. Also evident in works like *Nature's Metropolis* is the need for environmental history to build a bridge between the two worlds of ecology and history.

The Organic Machine by Richard White is another book that explores the relationship between natural history and human civilization.⁸ White's history of the Columbia River relates the relationship the people of the Pacific Northwest had with the natural environment. White explores how different groups of people connected with the river as well as the influence the river had with the people who depended on it for survival or economic gain. Like *Nature's Metropolis*, *The Organic Machine* explores the complexity of the human / nature interrelationship. White brings a dynamic approach to his research as he moves from Native Americans to the early settler and on to contemporary society—each successive group shaping and being shaped by the river in unique ways.

In a 2008 article titled "Three Dimensions of Environmental History" in *Environment and History*, J. Donald Hughes describes three factors that should be present when writing an environmental history.⁹ These three dimensions are nature and culture, historic and scientific method, and scale in time and space. Each of the dimensions represents a challenge for the researcher and a need for balanced scholarship. Because

⁸ White, Richard. *The Organic Machine*. New York: Hill and Wang, 1996. Print.

⁹ Hughes, J. Donald. "Three Dimensions Of Environmental History." *Environment & History* (09673407) 14.3 (2008): 319-330. *Environment Complete*. Web. 19 Jan. 2015.

environmental history is research that analyzes the interaction between humans and the natural environment and vice versa, it is important to carefully consider each of the three dimensions.

Nature and Culture

The first dimension described by Hughes is the dimension that is composed of the often-perceived dichotomy of nature and culture.¹⁰ This aspect of environmental history is crucial because it must represent how both human societies as well as the natural environment change over time. The reason that I use the phrase “perceived dichotomy” is because it is impossible to untangle the two actors in the relationship, even though they are often studied as separate phenomena. In order to be considered an environmental history, a study must take into account both as part of a complex and reciprocal relationship.

Environmental history, then, has in most cases transcended this dichotomy of culture and nature.¹¹ Often the melding of these two concepts is reflected in the titles selected for those environmental histories. *Nature’s Metropolis* and *The Organic Machine* are great examples of the books written by environmental historians intent on bridging a conceptual divide, because the very structuring of the titles suggests the need to create a realm where nature and culture are linked. The ability to connect various disciplines and viewpoints is also a valued aspect of environmental history.

¹⁰ Hughes (2008) 321-324

¹¹ Sutter, Paul S. "The World With Us: The State Of American Environmental History." *Journal Of American History* 100.1 (2013): 94-119.

The dichotomy of nature and culture is of specific interest when researching the past environmental history of the OBC. It would be very difficult to write any history of brewing in the region without considering the specific qualities of the natural environment that led to the success of such an enterprise. From the artesian wells, the abundance of hydropower and natural resources to the very presence of the Puget Sound water transportation, it is no surprise that a major brewing operation took root in Tumwater. It would also be of equal disservice to an environmental history to not consider the particular aspects of human society of the time that fostered the growth of this industry. The immigrants who came from Germany with the knowledge and skills to create an industry from the ground up, the farmers and craftsmen who had skill sets to foster steady growth, as well as the vast amount of technological and scientific information flourishing at the time, all contributed to the history of brewing in the Pacific Northwest.

Historical and Scientific Method

Using the methods of both historical and scientific research is an example of how environmental history often spans disciplines. Environmental history, while using the historical method, must also take into account how the scientific methods, may supplement the research.¹² Ecology in particular is of use to environmental historians because ecology places humans inside the web of life dependent on other species and equally subject to the forces of nature. Environmental historians do not need to be

¹² Hughes (2008) 324-326

experts in an area of scientific study, but they should be aware of the forces of change that led to the way the people in a particular time and place interacted with the natural environment and how that environment altered the human condition.

Considering both historical and scientific methods in an environmental history changes the viewpoint of the researcher, getting away from the notion that human society is the subject and the natural environment is the object. Bringing environment into the study of history should be considered similar to the way other historians have broadened the understanding of history by analyzing the roles that such topics as race, gender, and class played in shaping the world.¹³ While race, gender, and class are topics that are understood in the context of social science, environmental topics are often best understood through the methods of ecology, biology, and other natural sciences. Epidemiology is a good example of a field of studies where scientific methods can be used to understand diseases that decimated populations in the past. Another example of scientific methods being used to study historical developments is through hydrology, where the access to clean water has led to the rise and fall of civilizations. When a balance of historical and scientific methods is perused the conversation changes because there is a new lens to view the topic. Instead of applying an agricultural history approach, for example, which might consider how various farming techniques are “good or bad” for the land, the environmental history discussion shifts to a reciprocal relationship, where the interactions between humans and the land change each other through time. In a way environmental histories can show how human aspirations and

¹³ Nash, Linda. "Furthering The Environmental Turn." *Journal Of American History* 100.1 (2013): 131-135. 2015. P.133

failures are met in a world of finite resources organized in almost infinitely complex interrelationships.

Considering scientific methods when researching events that took place over a hundred years ago is complex business. Still there are important ways to consider balancing historic and scientific methods in this study. In fact the years leading up to the period of study saw scientific advancements that vastly changed the brewing industry and its capacity to influence larger and larger landscapes. Pasteurization, new industrial technologies, artificial ice, and changes in glass bottle manufacturing and capping are but a few examples. While brewing methods may have changed a little in the past century most of the advances were geared toward achieving greater output. It is not too far of a reach to assume that modern breweries of the same scale most likely use similar methods and techniques as Leopold Schmidt did at the turn of the twentieth century. Another example of how scientific and historical methods can both be brought into this study is by examining farming practices of the time. An example of this is written in notes from Schmidt's trip to Rubicon, Wisconsin in 1905. He wrote, "The farmers are learning from experience, to go into diversified farming, and are also being taught that by the Agricultural Experiment Stations. They are beginning to follow barley with pea, or clover crops, and sometimes corn, and seldom sow barley two years in succession".¹⁴ By looking into where and perhaps how the crops used to brew beer were farmed I will be able to discuss relevant changes to the land.

¹⁴ Olympia Brewing Company Archives, The Olympia Tumwater Foundation. Corporate Reports, annual reports 1905 box 3 notes from Rubicon page 4.

Scale in Time and Space

When considering “scale in time” it is important to understand that humans have been interacting with the natural environment throughout time.¹⁵ While this statement may seem a bit trite, it is important because the understanding, or concern for the environment, is not something exclusive to the modern world. The environmental awareness that exists in our contemporary world is not only the result of an understanding of the rapid changes we have seen, but also it is the result of a long history of relationships between humans and nature. Whatever period of study is selected—it is important to acknowledge that all history can be environmental history, it is a matter of choosing to explore the relationship that people had with their environment in their time.

The consideration of the scale of space is similar to that of time, in that the entire world is the space of concern.¹⁶ While any particular study may place special attention to a specific region it is important to acknowledge that nothing occurs in a vacuum and that each event or place is intimately connected to the rest of the world, especially when considering the aggregate effects of events of the past. The space within the ecosphere that is chosen must not be treated as though it exists uncoupled from adjacent places and larger landscapes.

One particular article in *Conservation Biology* addresses the issue of the need for greater connection between science and history in order to aid in conservation.¹⁷ The authors argue that the majority of differences between ecology and history are a

¹⁵ Hughes pp. 326-327

¹⁶ Hughes p328

¹⁷ SZABÓ, PÉTER, and RADIM HÉDL. "Advancing The Integration Of History And Ecology For Conservation." *Conservation Biology* 25.4 (2011): 680-687. *Environment Complete*. Web. 28 Jan. 2015.

result of miscommunication and even though the methods and concepts are quite different,¹⁸ there is actually a great deal of overlap in both the scale of time and space between history and ecology. Therefore, it is important to for any study of environmental history to set the appropriate scale and time frames.¹⁹ It is important to integrate both science and history into an environmental history study; the trick is to set both sides of the equation on equal footing.

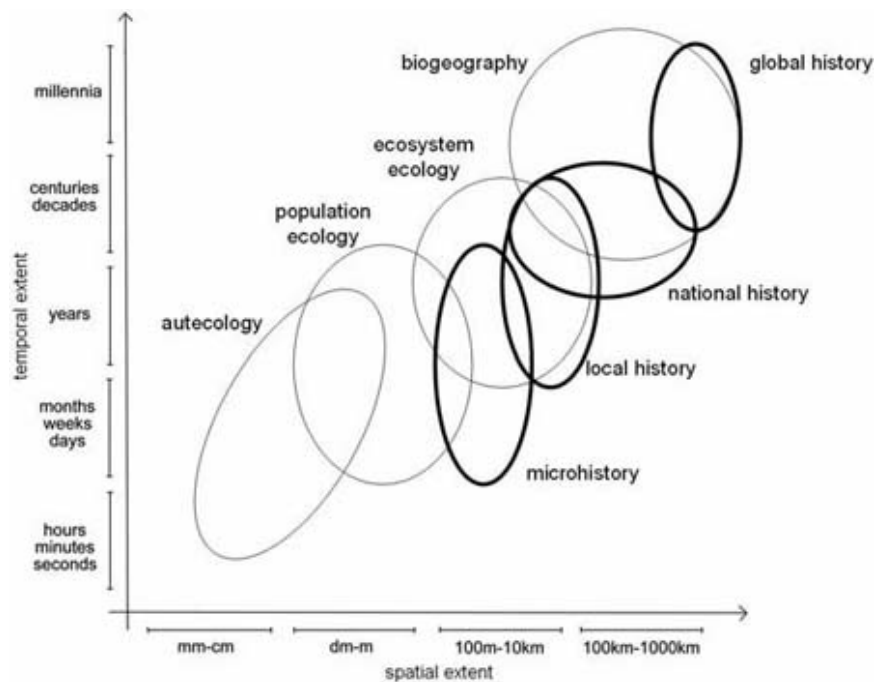


Figure 3. Spatial temporal overlap areas of history and science²⁰

While a study of The Olympia Brewing Company in the late nineteenth and early twentieth centuries does not at face value seem like a topic in which one would consider the vastness of time and space, it is important to consider that the events that occurred

¹⁸ SZABÓ et all (2011) p. 682

¹⁹ SZABÓ et all (2011) p. 684 This is important for my research in order to focus the main time and spatial components of my study.

²⁰ SZABÓ ET all (2011) Graph showing overlap in science and history.

during this period were influenced by history's long shadow. The railroad is an example of a technology and social enterprise that forever changed the landscape by making the most distant horizons easily accessible, allowing Olympia beer to be more widely distributed. Without such connection to the greater historical timeframe the story lacks a critical dimension.

Another way to consider how scale in time and space is linked to the OBC story is to illustrate how it affects us today. An example of this becomes very evident by simply taking a trip to Tumwater to witness actual changes to the land made over time. And while the beautiful falls have been changed greatly by the brewery and other industries that have called the site home, those industrial activities also influenced significant changes in a vastly larger landscape that can be understood to this day. While striving to understand the environmental and economic impacts that the OBC had on the local region and economy it is also wise to place it into the larger context of the nation or world. During this time agriculture was rapidly changing as farmers tried to maximize yields and reduce waste. Some crops, such as barley and hops, were taken up as quickly as breweries could produce them, while others were raised to feed a growing and hungry nation. The relationship between industry and agriculture is one that stretches across both the geographic landscape and the temporal landscape. As an industrial process improves efficiency, it then creates the ability, and perhaps the need to fill the new space created. Likewise, the profit motive often leads to efficiencies such promoting crops to be grown closer to the industries that use them.

Spatial and temporal landscapes are also intertwined and far reaching in the case of the OBC is found in the slogan "It's The Water." Imagine the great tectonic shifts and

glacial cycles that have created the landscape that lends itself to water, good for brewing beer, which was brought to the surface by artesian wells.

Lastly in the discussion of where the OBC during the time of this study fits into a discussion of having a larger effect in time and space would be to draw attention to the current lack of a brewery where the OBC once stood, examining the negative impact that it's loss had on the town of Tumwater. The historic brewery examined in this study is just one of many that surely played equally vital roles in their own regions.

Environmental History and Historic Breweries

The environmental history of breweries is an area of study that is vastly underrepresented today. Environmental histories are often focused on larger industries whose environmental impact is obvious and sometimes horrific. It is of course very important that those environmental histories be told, but it is also important to tell the story of smaller regional industries, whose environmental impact is less evident but especially profound when the larger landscape is considered. While there have been no similar studies to this environmental history of the OBC, such an omission makes the work even more significant. Not only are there likely many other breweries, or similar industries, that are a perfect subject for environmental historians, but the realization that each of them influenced a vastly larger landscape than its home footprint is essential to understand. When looking at the old brick building, the remnants of the 1906 OBC brewery on the Deschutes, few would understand the dramatic land use influence the company had on the Pacific Northwest and beyond. Ultimately I am not only arguing

that the Olympia Brewing Company is a good subject for an environmental history, I am also arguing for a conceptual framework about brewing and beer manufacture useful in structuring an environmental history. Life Cycle Assessment provides that useful framework.

Life Cycle Assessment

Like environmental history, Life Cycle Assessment began to emerge as a research method in the 1960s and 1970s as environmental issues such as pollution and resource conservation captured the public's attention.²¹ A study for the Coca Cola Company in 1969 became one of the first recognized uses of LCA methodology. Taking into account waste, resource requirements and emissions, that study compared different types of beverage containers.²² Soon LCA gained attention from government organizations such as the U.S. Environmental Protection Agency and the models became more sophisticated. During the 1990s, LCA studies became more standardized and consistent through the efforts of the Society for Environmental Toxicology and Chemistry and the International Organization for Standardization.²³ Currently, LCA has proven to be an important part of environmental research focused on sustainability and has become an important method used by the United Nations Environment Program. LCA will surely remain a useful tool and become more useful as it is refined and studied.

²¹ Guiney, Jeroen B, et al. "Life Cycle Assessment: Past, Present, And Future." *Environmental Science & Technology* 45.1 (2011): 90-96. *MEDLINE*. Web. 9 Feb. 2015.p.90

²² Guinée, Jeroen B, et al. 2011 p. 90

²³ Guinée, Jeroen B, et al. 2011 p. 91

According to the Environmental Protection Agency (EPA), an LCA provides an approach for assessing the environmental impact of a process, service, or product in three ways: first is the creation of an inventory of material and energy inputs and releases at all stages of the system; second, is an evaluation of the environmental impacts that may be associated with those releases; and third is an interpretation of the findings to provide guidance in decision-making. These three aspects provide the structure for how LCA is best used.²⁴

While LCA is rarely used to determine the environmental impact of a past industry, the method should be as useful in analyzing historical information as contemporary information, provided sufficient data are available. The extensive and nearly untapped but richly abundant Tumwater Olympia Brewing Company archives will yield the necessary information to make the historical application viable. While this approach may seem rather unconventional it is also a worthy experiment in interdisciplinary studies.

Life Cycle Assessments about beer and brewing

There are a few examples of the application of LCAs to the brewing industry today. While the studies are not applied to historical breweries, the studies establish an approach that may be emulated. In general the research has provided useful guidelines to those in the industry, which wish to achieve a smaller environmental footprint. The studies also emphasize stages of the manufacturing process that need to be addressed in order to reduce any negative influence on the environment. Those publications about

²⁴ United States Environmental Protection Agency, Life Cycle Assessment (LCA) <http://www.epa.gov/nrmrl/std/lca/lca.html#define> Accessed Feb 2nd 2015.

LCA research applied to the brewing industry can provide both guidance and a method of assessment useful to a study of environmental history.

One feature of the LCA method that lends itself to the brewing industry is that the approach seeks out areas of the greatest potential of lessening the environmental burden of the product. The production of packaging materials as well as transportation of products and raw materials provides great potential for lowering the environmental impact.²⁵ A study conducted on a popular Spanish beer followed the manufacture of a bottle of beer from raw materials to consumption and included every stage of the process. Among the improvement proposals were replacing the barley malting with facilities closer to the brewery, using returnable glass bottles as well as using recycled glass bottles. Interestingly, all of the recommended changes to the manufacturing process were in existence at most breweries, including the OBC, at the turn of the 20th century.

Another contemporary study was designed to assess the lowest environmental impact between two packaging options.²⁶ This study noted that the packaging solution that provided the least amount of environmental impact was the steel keg as opposed to the glass bottle. Fossil fuel consumption and land use change were listed as contributing the most to environmental impact. Also of note in this article is that the environmental impact of the consumption of the product was also evaluated. It was found that fossil fuel consumption and wastewater treatment costs generated by consumers was a large part of the environmental impact in this LCA. For a historical LCA it is difficult to

²⁵ "Environmental Analysis Of Beer Production." *International Journal Of Agricultural Resources, Governance & Ecology* 4.2 (2005): N.PAG. *Environment Complete*. Web. 3 Feb. 2015.

²⁶ Cordella, Mauro, et al. "LCA Of An Italian Lager Beer." *International Journal Of Life Cycle Assessment* 13.2 (2008): 133-139. *Environment Complete*. Web. 3 Feb. 2015.

determine particular aspects of environmental impact, such as amounts of fossil fuel used and pollutants released into the wastewater, but there is data on period transportation technologies such as steamships and trains. It is also worth noting that a significant portion of the OBC business involved the transportation of kegs not bottles.

In an attempt to propose improvements and optimize the system of manufacture for a brewery in Greece an LCA was conducted.²⁷ This study also followed the brewing process from raw material acquisition to distribution but did not consider consumer impacts in the system boundaries. Like the studies above it found that bottle production, packaging, and transportation were the parts of the system that contributed most to environmental impact. In these studies of modern breweries there are common factors that contribute to environmental impact and these factors may also be applied to an analysis of historical breweries.

Life Cycle Assessment and Environmental History

According to the guidelines provided by the EPA an LCA could be adapted to fit an environmental history once again provided there is enough data. Specific information available in the Tumwater Olympia Brewing Company records for the years that I am studying includes detailed annual reports, which provide information about the amounts and origins of raw materials purchased by the company. Those annual reports also detail where the finished products were distributed. The records of various accounts detailing

²⁷ Koroneos, C., et al. "Life Cycle Assessment Of Beer Production In Greece." *Journal Of Cleaner Production* 13.4 (2005): 433-439. *Business Source Complete*. Web. 3 Feb. 2015.

to whom beer and other products were being sold supplement that information. Those annual reports along with other archival sources such as letters, meeting minutes, and other forms of correspondence will provide enough information to create an inventory of energy releases and inputs. By looking to environmental practices of the day as well as brewery design and brewing methods it will be possible to draw conclusions about the environmental impacts using LCA. While applying this assessment to a historical situation cannot change past practices, the conclusions reached will provide a window into the environmental impact of those practices—many of which are part of the brewing industry yet today.

Barley

Grains were most likely the first ingredients of the earliest beers, barley in particular, along with water often fermented on its own. Throughout Europe barley became one of the main crops used in beer production. In the new world barley, which is not native to the Americas, also became a major crop for baked goods and animal feed but primarily for the production of beer. As European settlers spread westward many of them searched for lands suitable for growing barley. Over time it became a major production crop, especially across the northern tier of states and territories and along the west coast. As settlement moved west barley growing, industrial malting, and brewing quickly followed.

There are two main types of barley used for brewing, each having different qualities that affect the end product, as well as managing the brewing operation. These

two types are two-row and six-row barley, which at the time grew in different areas and were used differently. The name of each type of barley is a description of how the seeds are arranged on the stalk if one were to look down on it from above. The seeds on two-row barley grow in two lines down the stalk while the six-row form a star like pattern.



Figure 4. Two Row and Six Row Barley²⁸

Along with the differences in physical appearance the two different barley types poses different chemical properties that can be exploited in the malting and brewing processes. Two-row barley, which was almost exclusively used in Europe for brewing, yields more extract, meaning that more beer can be brewed from the equivalent of the six row variety. In the United States however, brewers tended to favor the six-row barley over two-row. One of the main reasons for this preference was that the climate of the Midwestern states was better suited the six row variety. While the two-row variety can produce more malt extract it was more expensive and lacked the higher enzymatic properties of the six-row. The higher enzymatic properties of the six-row meant that other starches added to the

²⁸ <http://www.homebrewersassociation.org/attachments/0001/5009/barley1.jpg>

brew, such as rice or corn, could more easily be converted to sugars and consumed by the yeast. Both varieties were used by the OBC throughout the years, which meant that the different regions that produce it supplied the barley. In some cases the different barley malts were described as eastern and western, where western malt was the two-row variety and eastern was the six-row. During the period under study, the barley from the Midwest (Wisconsin especially) supplied the six-row and western states produced the two-row. The question of why such a large portion of the barley was grown far away in the Midwest can be answered by taking into account the qualities of the type of crop that was grown in this region. The reason that the different types of barley were grown in different areas of the country is due to irrigation practices. Two-row barley grows best when irrigation practices are used which is the case in most western barley. In many cases the irrigation in western states was under contract with the maltster. In the mid-west it was cheaper to grow the six-row barley because irrigation was not as widespread.²⁹

Hops

As with barley there are different varieties of hops. Some are chosen for the bittering agent that gives beer a particular flavor and some for their aromatic qualities. The beer brewed at the OBC was some of the most sought after in the region and customers gladly paid a premium for it. Good hops were an integral part of that recipe. One particular variety of hops used by the OBC was a variety grown in Saaz, Bohemia,

²⁹ Schwarz, Paul. Horsley, Richard. "A Comparison of North American Two-Row and Six-Row Malting Barley." The Brewers Market Guide Online. <http://morebeer.com/brewingtechniques/bmg/schwarz.html> Accessed 1 June 2015.

which is still sought after for refreshing aromatic flavors. The relationship that the brewery has with hops and hops growers could lead to success or ruination.

Chapter 3: Brief History of The Olympia Brewing Company

The Olympia Brewing Company's history is one that is deeply rooted in the place in which it is located. The Deschutes River at Tumwater, Washington cascades over basalt that was laid down by ancient lava flows.³⁰ This area had been a gathering spot and important resource for Native Americans as well as early European settlers. Besides the falls this portion of the Pacific Northwest was perfect for brewing because of the access to ideal water from the artesian wells as well as its placement on the Puget Sound at a deep-water harbor and close proximity to burgeoning railroads. The importance of the existing landscape and resource will of course be discussed in greater detail later. Before the passion and ingenuity could bring forth an industry, the table was set by the land and geological history of the place.

The realization of what would become the Olympia Brewing Company is the result of the work of many brought forth by the talent, intellect, and drive of one German immigrant—Leopold Frederick Schmidt. Schmidt was trained as a seaman in Europe, a profession that influenced him deeply and from which he gained scientific training and a wanderlust that eventually brought him to the United States. Once in America he followed a number of pursuits including carpentry, tobacco pipe manufacture, and involvement in a musical instrument factory that produced zithers. Schmidt's entry into the world of brewing did not take place until 1874 when he was asked to oversee a brewery in Montana, which led to the establishment of the Centennial Brewing Company. Schmidt quickly developed a passion for brewing, which inspired him to delve deeply

³⁰ Stevenson, Shanna. *Olympia, Tumwater, and Lacey: a pictorial history*. Virginia Beach, VA: Donning Co. 1996 P.158

into the chemistry and science of the industry and eventually obtain his master brewer's certificate at the only brewing academy in the world at the time located in Worms, Germany.

Schmidt was in Olympia, Washington on other business when he discovered the future site of the OBC.³¹ After the water from the artesian wells was tested and found to be very desirable for brewing he decided that he had found the location for what would become his new enterprise and future legacy. In 1895 the location, which previously had been a tannery was purchased and on October 1, 1896 the first beer was produced at what was then called the Capitol Brewing Company. The brewery would soon become the familiar Olympia Brewing Company, through which Schmidt would come to control a significant portion of brewing in the Pacific Northwest. Along with the OBC, Schmidt would control five other breweries in Washington, Oregon and California by 1909. The year that this study concludes is 1916 which is the year that prohibition took effect and two years after Leopold Schmidt passed away. Because of Leopold Schmidt's keen business sense the OBC would weather prohibition, afterwards continuing on to many more decades of brewing led by his sons Peter and Adolf.^{32 33}

³¹ There is certainly more to tell about Leopold Schmidt but this short biography of his early life is only to set the stage. Brewery Gems. Biography of Leopold F. Schmidt, Founder of Olympia Beer. Website <http://brewerygems.com/schmidt.htm> accessed February 8, 2015

³² Stevenson, Shanna.1996 P158

³³ There is more detailed information in the listed sources about Leopold Schmidt and The Olympia Brewing Company. This section is only meant as an introduction.

Chapter 4: Methods

The two main goals of this study are to research and write an environmental history of the early years of Olympia Brewing Company operations, and apply Life Cycle Assessment methods to a more traditional historical analysis. By combining environmental history with LCA, this research not only develops an environmental history of great importance to the Puget Sound Region and beyond, it also broadens the field by applying LCA to a historical topic, thus creating a new lens through which the information gathered in environmental history may be evaluated.

The Olympia Brewing Company Archives

The primary archives I have used for this study are located in the Schmidt House in Tumwater, the historic home of Leopold Schmidt. When the OBC was sold the archives were brought to the house, which has been owned by the Olympia Tumwater Foundation since 1983. At that time the archives were in a state of disarray and were in danger of being lost. Due to the diligent work of the Olympia Tumwater Foundation staff, the archives were organized and placed into a temperature and humidity controlled room. Currently archivists are working on another effort to better organize and index records in the archive, further cataloging and preserving the collection.

Even though the archives are located in a single room in the basement of a historic landmark, they contain a wide range of period information including letters, meeting minutes, annual reports, architectural drawings and much more. Most of the

collection is currently in banker's boxes and organized topically and chronologically. Although changes are underway, the current index is in the form of Excel tables.

While much of the material is useful to this study, I have found that the annual reports are particularly germane because each provides a single-year snapshot of the company's history. Those reports include information such as the amount of raw materials purchased, the geographic location of those materials, and the volume and location of beer sales. More detail and support for research conclusions is found in family letters, newspaper clippings, telegrams, and other related documents.

Historical Research Methods

In narrative-based historical research methods, the researcher applies a controlled, rigorous, systematic, verifiable, empirical, and critical approach to information gathering and analysis. Because reputable history draws a large distinction between the validity of tertiary or secondary sources and primary sources, the researcher is expected to follow leads from sources where others have already offered their own structure and interpretation, to original sources of the time and place under investigation. Useful primary sources may include physical evidence such as archeology, extant architectural structures, and landscape features, as well as archival sources such as letters, period news reports, business records, photographs, maps and plans, and telegrams. Historical method also requires the researcher to leave a clear record of her or his study through well-written analytical notes, clear and accurate citations, and a comprehensive bibliography,

so that future researchers may follow the same trail and also double check the reliability and validity of the researcher's conclusions.

Life Cycle Assessment and Historic Data

A crucial part of any environmental history is the interpretation of past events and the description of change over time. The LCA part of this study plays a very important role, in that it takes the information that I have gathered and places it into a quantitative context. Despite its usefulness, this study is not meant to be a stand-alone LCA, because several important parts critical to the overall interpretation of the narrative do not perfectly link to an LCA approach.

That reality led me to adopt a hybrid approach to LCA. The way in which the two methods of environmental history and LCA were incorporated was by finding places within environmental history that could be informed by methods of LCA. LCA was used to help form the environmental history by setting a different type of framework that is not normally used. It was also necessary to use a hybrid approach because when applying the method to historical information, I found that most LCA software incorporates databases inappropriate to a historical analysis, because they were created to be applied to complete contemporary information sources. The direct application of that modern software would also be inaccurate because of changes in technology and science that have taken place over the last hundred years. A simple example of this problem is that modern transportation data includes diesel-powered trains and trucks and not coal-powered trains and steamships. Agriculture has also changed significantly since Leopold Schmidt's

time. All of the data that I have looked at includes environmental impacts from synthetic pesticides and fertilizers that were not in widespread use until after World War II. Nevertheless, it is possible and very useful to use the basic LCA approach as part of an environmental history as long as the historical data can be analyzed applying general LCA guidelines.

Procedural Guidance

The U.S. Environmental Protection Agency provides useful guidelines on conducting LCA that are applicable to many different types of studies and do not rely upon any particular software or database.³⁴ This document, which is available for download on the Internet, provides guidance about LCA basics as well as recommended procedures and discussion. As I conducted this study I have used this document to focus and apply the work to the appropriate context. According to the EPA there are four phases of an LCA.³⁵

1. Goal Definition and Scoping: Define and describe the product, process or activity. Establish the context in which the assessment is to be made and identify the boundaries and environmental effects to be reviewed for assessment.

³⁴ United States Environmental Protection Agency (“Life-Cycle Assessment | Sustainability Analytics | Research | US EPA”) 2006

³⁵ United States Environmental Protection Agency (2006) pg.2

2. Inventory Analysis: Identify and quantify energy, water and materials usage and environmental releases (e.g., air emissions solid waste disposal, waste water discharges).
3. Impact assessment: Assess the potential human and ecological effects of energy, water, and material usage and the environmental releases identified in the inventory analysis.
4. Interpretation: Evaluate the results of the inventory analysis and impact assessment to select the preferred product, process or service with a clear understanding of the uncertainty and the assumptions used to generate the results.

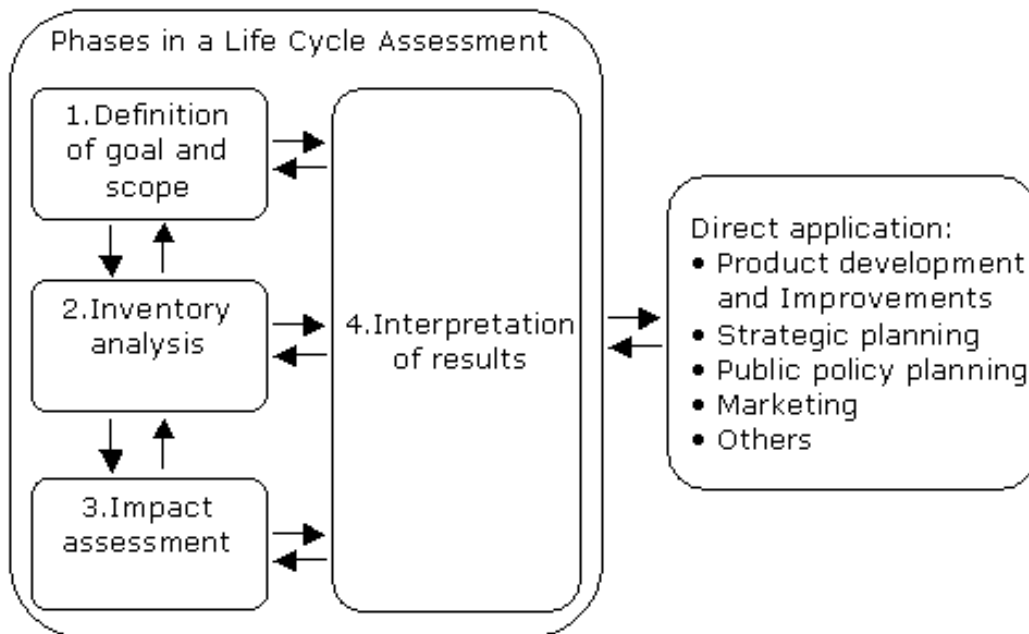


Figure 5. Phases of LCA³⁶

³⁶ <http://www.lcafood.dk/lca/lca.htm>

Those guidelines form the basis of how I apply LCA to the environmental history of the OBC.

Goal Definition and Scoping

This phase of an LCA study sets the course for the rest of the research. This part of the study defines the boundaries and ensures that superfluous or unaccounted for variables do not disrupt or hinder the study. Decisions made during the goal definition and scoping phase effect both the relevance of the results as well as the way in which the study will be conducted.³⁷ The goal and scoping of this study was carefully designed, in keeping with the type of evidence available.

For the environmental history of the OBC the goal is to inform the reader about far-reaching and often overlooked impacts. Three types of information categories were needed and sought out in the archives and other sources used in this study. 1) Information pertaining to the raw materials used in the brewing process in the first part of the cycle was studied. 2) The distance and location of raw material and distribution sites was also analyzed as a part of the LCA method. 3) Finally, important consideration was given to the types of waste or reuses of resources that were part of the life cycle. By further breaking down these three categories the scope of the study becomes clear.

³⁷ United States Environmental Protection Agency. 2006Pg.7

Functional Unit

In this study the functional unit is one barrel of beer during a particular cycle of brewing. In order to get to the small scale of one barrel I needed to examine an entire month of brewing during selected years. The months and years used were chosen with consideration of the season, since there is a lot of seasonal variation in brewing. This unit works best because it most closely coincides with primary documents and how records were originally kept by the OBC. Many studies of modern breweries are able to use one bottle of beer as their functional unit but that was not applicable to my study, because I am concerned with a twenty-year time span instead of a fixed moment in time and because so much of the beer produced in this period was never sold by the bottle. Because some of the information in my timeframe were more complete than others this method also allowed me fill gaps by to extrapolating information from other months or adjacent years to complete a picture of the entire time frame. Using this approach I was able to study how the OBC changed as it grew in relation to land use, transportation needs, and waste products.

Raw Materials

The raw materials that were considered for this study are the agricultural and natural resources that went into the brewing process. While there are other materials involved such as bricks, stationary, bottle caps and many others, I set the boundaries of the study as such due to the scope and time constraints. Each raw material was also studied based on available information about quantities, places of origin, and agricultural

acreage. Those data plus an estimate of crop yield per acre from other evidence found in primary correspondence and other sources provided the amount of land used to grow these crops. This raw material analysis is the first part of the historical LCA that I have developed.³⁸

STATEMENT
OF MATERIALS USED IN THE MANUFACTURE OF BEER FOR
YEAR ENDING SEPTEMBER 30th, 1905.

	Malt Pounds	Rice Pounds	Grits Pounds	Grape Sugar Pounds	Hops Pounds
1904. October,	167030.	15100.	48600.	7420.	3845
November,	129250	15200	37100	3290	2799
December, 1905.	99900	10700	28800	79600	2128
January, 1904	106000		41300	5160	2532
February,	167920	31860	32800	4704	3355
March,	125130	13124	74000	21161	5043
April,	215640	26600	54460	9192	4639
May,	223590	33561	47433	9629	4738
June,	274050	22970	76690	13571	5968½
July,	251226	32136	69124	12320	5251½
August,	287130	42150	68250	18825	5781
September,	241040	25000	64420	9895	4428
Totals,	2287906	265401	642977	123127	50508

Number of barrels brewed during year 67949

³⁸ Barley Grain = 48 lbs.
Barley Malt = 34 lbs. Malt is sprouted and dried barley.

Figure 6. Sample list of raw materials for beer

Transportation

The next step in the life cycle of the OBC is the transportation that took place in both bringing the raw materials to the breweries as well as bringing the product to the consumers. There is evidence of where the raw materials came from in most years since the type of malt and hops used, often were named for their places of origin. There are also lists of accounts naming locations to which beer was distributed. This information coupled with information about the transportation modes of the time can provide

evidence of the transportation methods and networks that were needed.

Paddock & Bruzas.	-----Wilkison.	-----	17.50
Lewis Bertrand.	-----Olequa.	-----	94.15
L. H. Dee.	-----Honolulu.H.T.	-----	3124.95
F. F. Smith.	-----Aberdeen.	-----	377.60
Macfarlane & Co.	-----Honolulu. H.T.	-----	517.25
Fraser & Parsons.	-----Shelton.	-----	42.90
Foster & Mc Intosh.	-----South Bend.	-----	107.15
E. W. Dooley.	-----North Yakima.	-----	632.60
F. B. Shardlow.	-----North Yakima.	-----	1349.60
O. Rentzsch.	-----Ellensburg.	-----	218.90
Chas. Stubling.	-----The Dalles.	-----	127.35
Fred Snyder.	-----Ellensburg.	-----	100.50
Foster & Mc Intosh.	-----Pendleton	-----	187.60
T.C.Rush.	-----Chehalis.	-----	96.50
Dan Salzer.	-----Centralia.	-----	101.45
Fred Ernst.	-----Gate City.	-----	4.55
Fraser & Maize.	-----Elma.	-----	76.00
Gus Meisner.	-----South Bend.	-----	230.40
J. G. Kendall/	-----Montesano.	-----	105.50
Bachtold & Ackerman.	-----Walla Walla.	-----	114.19

Figure 7. Examples of Accounts Showing Distribution

Waste Products and Recyclables

The waste products of this LCA was the most difficult to quantify. There are several bits of information that assisted in fleshing out this part of the study. For example, there are numerous references to the cost of buying back empty bottles, freight to bring them back and machines used to wash them. This reusing of bottles is of great

importance when considering the waste products of the OBC. The historical record also indicates that spent grains from the brewing process were supplied to farmers as feed for livestock. Along with these examples of reuse there are also concerns about water pollution and solid waste disposal that, while not really quantifiable because those records weren't kept, are definitely worth discussing especially if some estimate can be gathered from the historical record. It was important to bring the LCA study to the conclusion of the final waste products in order to see the bigger picture.

After reviewing the information that is available I found that the study focus that would be most meaningful for the quantitative portion of this study would be on the barley and hops used to brew the beer. Because it is a lengthier case study there were two years selected for examining the brewing for an entire month. For this portion of the study the month of October in the years 1900 and 1910 was chosen. This allowed me to examine an entire month of brewing to assist in determining the total acres used during that time. It was necessary to do this in order to determine that the batches chosen for a barrel analysis would be representative of the batches brewed at the time. When focusing the results down to one barrel of beer, I was able to choose seven different batches brewed in the years of 1900, 1903, 1907 and 1910. During these years there were two different types of beer brewed, a lager and a bock. The differences between lager and bock beer allowed me to look at another comparison based on style of beer brewed.

Chapter 5: Results

The information collected for the study of the origins and land use impact of barley and hops production yielded interesting results. One important factor in considering the results of this study is that the quantifiable results are formulated by using the primary source of brew records and correspondence. In conducting this study of historical information I tried to use evidence that was as close to the years of the information in the brew records as possible. Because of this, the information concerning calculations, such as yield per-acre, are based on evidence from the time period of this study. Working with this evidence was particularly rewarding because much of the information was hand written and provided a more personal connection to the events that took place more than a hundred years ago.

Case study for barley October 1900 compared to October 1910

By examining the places from where malt was purchased during the month of October for the years of 1900 and 1910, I was able to gain concise information about the land use required to brew beer during those two short periods. As a result of this study I was able to determine where the malt was manufactured based on correspondence from the period and other sources that reference places and names listed in the brew records. Because the malting process creates a lighter product than the original barley, it was necessary to develop a reasonable conversion formula. The respective weights are important when considering the actual dollar and resource costs of travel to the OBC.

Total Malt October	1900	Total Malt October 1910	
Pounds Used	86571	Pounds Used	166580

Table 1 Total amount of malt used in 1900 compared to 1910.³⁹

The total amount of malt used represents the amount that was used during the entire month, showing a significant increase over the ten-year period. The increase of more than eighty thousand pounds of malt used was necessary as the brewing operation continued to expand and become more efficient in an effort to keep pace with the growing demand. While table I illustrates this overall expansion, it does not place the products used in brewing into a geographic location.

Location of Malt Manufacture

During the years chosen for this study the malt came from two regions and from three different maltsters.⁴⁰ The two regions, from where the OBC obtained barley converted to malt, were California and southern Wisconsin. All of the malt used from California was purchased from San Francisco, most likely from the Bauer Schweitzer malt company. The malt from Wisconsin came from two different locations, the Ladish-Stoppenbach Company in Jefferson Junction and Rubicon Malting and Grain Company in Rubicon. The place names are referenced in the brew records and were confirmed by examining correspondences and brewing journals from the historical time period. I made

³⁹ The amount of malt used during these years was gathered by adding amounts recorded in the Brewery record books. Each line item represented a particular brewing session. These Brew Records are located at the Schmidt House or "Three Meter" and are in the control of The Olympia Tumwater Foundation.

⁴⁰ Maltster is a term for malt manufacturing that I came across a few times in the historical records.

the assumption that the barley used for malt manufacture would have come from areas nearby where the malt originated.⁴¹



Figure 8. Letterhead from Bauer Schweitzer Hop & Malt Company⁴²



Figure 9. Letterhead from The Ladish-Stoppenbach Co⁴³

⁴¹ Historical maps later used show where barley was grown which is clustered around the places mentioned.

⁴² This letter from the Bauer Schweitzer Hop and Malt Company was written to the OBC about moving operations after the Malt House was damaged by fire. The company had been in existence since the 1870's. Olympia Brewing Company General Files Subject Files A – Z, 1900-1903, Box 1

⁴³ This letter from the Ladish-Stoppenbach Co. concerns a shipment that was low. This letter is from 1913 but Jefferson Junction is mentioned throughout the years studied. There are a couple of changes in the names of the title of the company but Stoppenbach is consistent. Olympia Brewing Company General Files Subject Files A – Z, 1900-1903, Box 1

KRAUS, FRED, Galland-Henning P. M. D. Mfg. Co., Milwaukee, Wis.	the
KAMM, P. C., P. C. Kamm & Co., Milwaukee, Wis.	M
KREUTZ, PETER, Rubicon Malting and Grain Co., Rubicon, Wis.	As
LUEHKERT, OTTO, Saladin Pneumatic M. C. Co., Chi-	

Figure 10. From *The Index of The American Brewer's Review*^{44 45}

Malt to Barley Conversion

One factor to consider in assessing the land use associated with the malt that was used is the fact that a bushel of barley does not weigh the same as a bushel of malt. A bushel of malt weighs 33 or 34 pounds, depending on whether or not it is cleaned or uncleaned, and a bushel of barley weighs 48 pounds. However, bushel weight should not be used to determine the malt to barley conversion because some of the “Malt Increase” is turned into profits for the maltster.⁴⁶ Determining the conversion from barley to malt can be cumbersome because of the many variables to be considered in the calculation. The type of barley, the moisture content and even the weather during the growing season can affect the conversion rate. Because of the difficulty in determining all of these ancillary factors on historical information across many regions it was necessary to determine a simple conversion that could work for all of the areas studied. After

⁴⁴ Peter Kreutz of the Rubicon Malting and Grain Co. attended an open-air concert on August 6th 1902 at the Duetscher Club for an event hosted by The Milwaukee Malting Co. *American Brewer's Review*, index, Volume 16. 1902 Pg. 75 Original from the University of California Digitized Mar 21, 2013

⁴⁵ In 1905 Leopold Schmidt visited malt houses in Rubicon and Milwaukee, letters from his trip exist in the archives.

⁴⁶ One bushel of barley weight is per the USDA. This was also true in 1901. *American Handy Book of the Brewing, Malting and Auxiliary Trades: A Book of Ready Reference for Persons Connected with Brewing, Malting and Auxiliary Trades ...* Editors Robert Wahl, Max Henius Edition 2editors, 1901 the University of Wisconsin - Madison Jun 19, 2009 1266 pages

searching historical records I decided to use an average decrease of 20% from barley to malt. The number that I finally settled on was a result of a 1912 court case where it was stated, “100 pounds of barley yields 80 pounds of malt.”^{47 48} The decrease in weight from barley to malt makes it possible to determine the amount of barley that was used, because the records clearly indicate the amount of malt purchased.

1900		Pounds Malt	Pounds Barley
Jefferson Malt		44,209	55,261.25
California Malt		42,362	52,952.5

Table 2 Increase from malt to barley in 1900

1910	Pounds Malt	Pounds Barley
Jefferson	64,515	80,643.75
Rubicon	77,715	97,143.75
California	24,350	30,437.5

Table 3 Increase from malt to barley in 1910.

⁴⁷ The increase in barley from malt is derived from a court case in 1912 where the shipper was buying at barley prices and selling at malt prices. There are many variations on what percent of barley weight is lost in malting but this seems to be a good middle point. Traffic World, Volume 9 Traffic Service Corporation. 1912

University of Minnesota Aug 18, 2014

⁴⁸ A former brew master of the Olympia Brewing Company also stated this number to be a good estimate.

Land Use Per Acre

In order to make a statement about the land use that was necessary to grow the barley that made the malt, the yield per acre of barley crop must be known. This information is available in *The Yearbook of The Department of Agriculture*. Fortunately, in the case of barley, I was able to use yield information as it pertains to the particular years of this study. According to the yearbook the bushel yield per acre in 1900 was 25.5 for Wisconsin (Jefferson) and 16.7 for California.⁴⁹ In 1910 the yields were 25.9 for Wisconsin (Jefferson and Rubicon) and 31 for California.⁵⁰ By dividing the total pounds of barley used by the 48-pound bushel weight that was previously discussed the total amount of bushels used can be found. The amount of acres needed to grow the barley in the times and places of the study were found by dividing the total bushels by the yield per acre. While it may not be possible to determine on which farms the barley was grown it is an accomplishment to narrow the land use to a quantifiable number of acres in a particular region on the country.

Acres Used		
	1900	1910
Jefferson	45.14	64.86
Rubicon	N/A	78.14
California	66.05	2.09

Table 4 Acres used to grow barley for beer brewed in October 1900 compared to October 1910.

⁴⁹ U.S. Department of Agriculture, National Agricultural Library, Yearbook of the United States Department of Agriculture 1906. Volume 1907 U.S. G.P.O Pg. 572

⁵⁰ U.S. Department of Agriculture, National Agricultural Library, Yearbook of the United States Department of Agriculture 1910. Volume 1911 U.S. G.P.O Pg. 537

Distance Barley Traveled

When considering the environmental impact of the barley that was used in the brewing for the months of this study, it is crucial to take into account the distance the converted barley traveled to the brewery. Ideally it would be best to use the particular routs and means of travel to do this calculation, narrowing the distance to one or two options. Due to the uncertainty involved in which routes were chosen and how the product was moved during the time period I have chosen for now to use linear distances from the place of origin (malt manufacture) to the brewery. The furthest distance away from Tumwater, in the case of malt, was Rubicon, Wisconsin, while California is considerably closer. Most likely during the first part of the twentieth century the malt would have moved across the country in rail cars. I have determined that during that time boxcars could carry 40 tons of freight (information that will be useful in later study).⁵¹ For now it can reasonably be assumed that shipping from further distances required more energy, in this case coal. Considering the distance that the raw materials travel is important when assessing the land use and environmental impact of any product.

⁵¹ The Railway Age, Volume 31 Published 1901, Original from the New York Public Library. Digitized Jan 8, 2010 Pg. 138

Location	Linear distance to Tumwater in miles
Jefferson Junction, WI	1,679.24
Rubicon, WI	1,687.37
San Francisco, CA	637.25

Table 5 linear distances from source of malt to Tumwater Washington.

Case Study for Hops October 1903 compared to October 1910.

Hops are another of the main ingredients required for the brewing of beer and have one of the largest impacts on land use. Ideally I would have liked to compare hops along with barley for the same years. Unfortunately the brew record for hops in 1900 does not list the locations. The next year that I was able to find where the source of the hop crop was listed was 1903. I still used the month of October to compare the two years due to the seasonal variability of the beer recipe and what crops were available. This comparison still demonstrates change in where the hops were grown as the OBC prospered. The change in the places where the hops were grown is rather dramatic in just the few years from 1903 to 1910. This change represents a shift in agriculture that followed the demand.

Location of Hops Growing Regions

In the first year of the study the hops were all grown outside of Washington State and in the later years I found that most hops were grown in the same region as the brewery. For the hops that were purchased from California I used San Francisco as the place of origin because the same company that produced malt, Bauer Schweitzer, also provided hops. For Oregon there is evidence that the hops was bought from a broker in Salem. The place names that were listed in Washington are towns that are still in existence and the land around them is known for historically producing hops. The most far-flung location of Saaz Bohemia is very well known for producing high quality desirable hops even today. The locations used to grow hops for the OBC represent a shift in agriculture as the demand grew in the Pacific Northwest.



Figure 11. Letterhead from Kola Neis, a Hops Broker in Salem, Oregon⁵²

⁵² This Correspondence from a hops broker is discussing a legal matter concerning by laws. Olympia Brewing Company, General Files, Subject Files Correspondence, Miscellaneous 1890-1917 Box 1



Figure 12. Letterhead from Epstein Mendl and Grube Purveyors of Choice Bohemian Hops⁵³

Amount of Hops Used

The total amount of hops from each location for October of each year was calculated from the brew records. In the case of 1903 the amounts were listed by origin for each brew, of which there were several each day. For 1910 the list is a simple tally of inventory received and used, which was separated by location. In October 1903 the most hops were grown in Oregon, followed by Bohemia and California. The case is different in 1910 when the largest amount of hops were grown in Washington State followed by Oregon, California then Bohemia.

⁵³ This Correspondence is concerns a visit of Mr. Adolphus Kaufmann to Tumwater for sales. The emblem of the emperor of Austria is gold and still shines. Olympia Brewing Company General Files Subject Files A – Z, 1900-1903 Box 1

1903	Pounds of Hops
Salem, OR	1,668
San Francisco, CA	782
Saaz, Bohemia	471
Total	2,921

Table 6 Hops used by location in October 1903.

1910	Pounds of Hops
Salem, OR	741
Orting, WA	180
Chehalis, WA	1,230
Saaz, Bohemia	422
San Francisco, CA	611
Total	3,184

Table 7 Hops used by location in October 1910.

Hops Land Use Per Acre

Finding a yield per acre value for hops was a little more difficult than it was for barley.

Because, unlike with barley, I was unable to find yield per acre values for hops from each specific year, I needed to rely upon a 10-year average found in a crop report from

1907.⁵⁴ Fortunately the states that were listed were Oregon, Washington and California. The reported values were Oregon at 1000 pounds per acre, Washington at 1300 pounds per acre and California at 1200 pounds per acre. For Bohemia the yield per acre was found in *The International Brewers Journal* to be 500 pounds per acre but of exceptional quality.⁵⁵ Because hops crops experience drastic gains and declines it would be best to know the yield each year by state specifically, but the averages are a good estimation. These yield per acre values were used to determine the land use impact in terms of area for the hops used during the years of the study.

1903	Acres Used
Salem, OR	1.66
San Francisco, CA	1.30
Saaz, Bohemia	0.39
Total	3.36

Table 8 Acres used to grow hops in October 1903.

⁵⁴ United States. Dept. of Agriculture. Bureau of Statistics. Crop Reporter ..., Volumes 8-10 U.S. Government Printing Office, 1906. University of Chicago, Digitized Jun 17, 2011 Pg. 77

⁵⁵ International Brewers' Journal, Volume 44. W. Reed. 1908 the University of California, Digitized Apr 24, 2013 Pg.497 In these journals weights are often given in cwt. which means hundredweight, just the number plus 100.

1910	Acres Used
Salem, OR	0.74
Orting, WA	0.13
Chehalis, WA	0.94
Saaz, Bohemia	0.70
San Francisco, CA	0.50
Total	3.03

Table 9 Acres used to grow hops in October 1910.

Distance Hops Traveled

As with barley it is very important to consider the distance that the hops needed to travel to the brewery in order to more comprehensively understand the environmental impact of the raw materials used. As with barley the hops most likely traveled to the brewery by train, with the exception of the crop of Bohemian hops, which would have made a long steamship voyage. If the information concerning resources and routes used to make these journeys could be found it would further improve the accuracy of this study. For the time being I have used the linear path along the ground to determine distances.

Column1	Linear Ground Distance in Miles
Salem, OR	143.36
Orting, WA	33.38
Chehalis, WA	24.8
Saaz, Bohemia	5242.28
San Francisco, CA	636.59

Table 10 Distance from source to Tumwater, WA.

Land Use Per Barrel

While it is of great use to study the origin and land use impact of the raw materials over an expanse of time, it is also critical for use in a life cycle assessment that the functional unit be paired down to what would go out to the consumer. It would have been extremely difficult to start with this small unit without first understanding the larger picture of the supply chain as it existed in the historical context. So far I have examined the land use of the beer in terms of the yield per acre that I have found for the times of the study over an entire month of brewing. In order to examine the land use of the OBC and how it changed over time, I calculated the land use of one single barrel of beer. Using that information, along with information in the annual reports of the company, the land use was scaled to something that is more tangible.

By using the annual report information that is available I was able to identify the average amount of raw material that was used per barrel.

Material	Weight (Lbs.)
Malt	1474371
Rice	79600
Grits	431100
Wheat	32190
Cerealine	27100
Total	2044361

Number of barrels of beer brewed during year==41996.

Average number of pounds of malt, rice, grits, wheat and cerealine taken together, to each bbl. of beer manufactured==48.68 Lbs.

Average number of pounds of hops to each barrel of beer manufactured==.8267 Lbs.

Figure 13. Barrel Breakdown of Raw Materials Used in 1902⁵⁶

For some years the yield in barrels for each batch appears in the ledger, but unfortunately it is not for other years. For this reason I used this average barrel breakdown from 1902 in order to come to a good estimate for how many barrels were brewed in each batch for the years that do not explicitly show that yield. I chose this breakdown from the annual report of the following year because it is the first year during the period of study that calculated a barrel in this way. Taking the amount of hops and malt for batches in 1900, for example, I came to the estimate of about fifty barrels per batch. Luckily there are a few batches in that year (1900) with the actual barrel yield and my results were close enough so that I am confident this is a good method of estimation. I used this method of estimation only when the batch that I looked at did not have a yield in barrels listed.

⁵⁶ Olympia Tumwater Foundation. Olympia Brewing Company, Corporate Records, Reports, Annual Reports, Olympia Brewing Company 1900-1915 Box3

Although there was a good deal of bottling at the time, a barrel is the easiest way to scale the brewing operation down to a single unit. While one barrel of beer is more beer than any one person could drink within a reasonable amount of time (about 331 bottles),⁵⁷ it is the amount that was most commonly sold and tracked in the records. Also a large portion of beer in those days was consumed in saloons and not purchased as individual bottles. Bottling was done in the most cases in order to better preserve the beer for shipping.

October 1st 1900	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Jefferson Junction	900	1125	23.43	0.91
California	900	1125	23.43	1.40
	Pounds Hops			0
California	35			0.029
			Total Acres Used For Batch	2.35
			Per Barrel Acres Used	0.047

Table 11 Lager Brewed on 1900.

⁵⁷ Dodge, John "Old Olympia Beer Brewhouse Remains Object of Fascination" The Olympian. November 24th 2013

October 1st 1903	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Jefferson Junction	1750	2187.5	45.57	1.64
California	100	125	2.60	0.10
	Pounds Hops			0
Oregon	0			0
California	21			0.017
Bohemia	18			0.03
			Total Acres Used For Batch	1.79
			Per Barrel Acres Used	0.035

Table 12 Bock Brewed in 1903

October 3rd 1903	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Jefferson Junction	1700	2125	44.27	1.59
California	100	125	2.60	0.10
	Pounds Hops			0
Oregon	25			0.025
California	15			0.012
			Total Acres Used	1.737
			Per Barrel Acres Used	0.034

Table 13 Lager Brewed in 1903.

In an effort to broaden the results for acres used in the production of barley and hops I have added two batches brewed in 1903 and 1907 along with the previous study of 1900 and 1910. The reasoning for this is that it allows for the study of more points along the timeline of this analysis. It also provided the opportunity to compare the differences between the bock and lager beers that were brewed at that time. Because of this I added in a couple of malt manufacturers previously unmentioned. The first new malt is called Northwestern, which was most likely made from barley grown in Washington and Idaho, on what is known as the Palouse region.⁵⁸ The other source of malt in 1907 and 1910 was the Rahr sons company of Manitowoc Wisconsin.⁵⁹ By adding these years I was able to make the study of land use per barrel more meaningful.

⁵⁸ I came to this conclusion based on a conversation with Paul Knight who was the brew master for the Olympia Brewing Co. from 1974 until a few years before the end of the company. It is important to note that there was the Northwestern Malt and Grain Co. in Chicago during that time. Because of the conversation, and that Chicago was further east than where most barley was grown, I based the calculations for Northwestern malt on Washington yields.

⁵⁹ United States Brewers Foundation, Proceedings of the Annual Convention, Volumes 45-47, United States Brewers' Association 1907. The William Rahr sons Co won the grand prize for beer in 1906.

October 1st 1907	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Jefferson Junction	10,310	12,887.5	268.48	10.36
	Pounds Hops			0
Oregon	56			0.056
Chehalis	73			0.056
Bohemia	75			0.125
			Total Acres Used	10.60
			Per Batch Acres Used (292)	0.036

Table 14 Bock Brewed in 1907

October 2nd 1907	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Northwestern	4,800	6,000	125	4.31
Rubicon	5,700	7,125	148.43	5.73
	Pounds Hops			0
Oregon	182			0.18
Puyallup	22			0.016
			Total Acres Used	10.24
			Per Barrel Acres Used (300)	0.034

Table 15. Lager Brewed in 1907

October 4th 1910	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Jefferson Junction	12980	16225	338.02	13.05
	Pounds Hops			0
Orting	70			0.053
California	110			0.091
Bohemia	20			0.033
			Total Acres Used	13.23
			Per Barrel Acres Used (291)	0.045

Table 16 Bock Brewed in 1910.

October 2nd 1910	Pounds Malt	Pounds Barley	Bushels Barley	Acres Used Per Batch
Rubicon	8,635	10,793.75	224.86	8.68
California	2,435	3,043.75	63.41	2.04
	Pounds Hops			0
Oregon	60			0.06
Chehalis	135			0.10
			Total Acres Used	10.89
			Per Barrel Acres Used (291)	0.037

Table 17 Lager Brewed in 1910.

Chapter 6: Discussion

The results of this study yielded some findings that were to be expected and some that were a little surprising. One of the expected results was that, as the OBC grew in size the acres used naturally increased. This was the case for barley when comparing the month of October in the years 1900 and 1910. One surprising result is that the acreage used to grow the hops during those years was found to have slightly decreased. When looking at the acreage consumption per barrel what is striking is the lack of fluctuation. The variation in per barrel acres used only fluctuated from 0.034 to 0.47 of an acre. The consistencies and variation found in this study are likely the result of a combination of business practices, changes in agriculture and economies of scale.

Barley and The Olympia Brewing Company

While some barley was directly grown for the OBC for several years during the period of study, those experiments met with a mixed record of success. One of the most important factors in the choosing of where barley was grown was the variety of barley that was grown in each particular region. Another factor that led to barley being extracted from a particular area was the density of barley crops being produced in that region. Barley itself is not useful for brewing until it has undergone the malting process, which was and remains a labor-intensive industrial undertaking. Transportation also would have played a major role in where barley was sourced. Another important factor to consider is the professional relationships that existed between the brewer and the producers of malted barley. The soil, which produced the barley that produced the beer

brewed by the OBC, is as much of a subject of cultural forces as it is of nutrients, sun and rain.

Density of Barley Farming

While Barley farming was possible in many areas of the country it is important to consider where the highest concentration of barley farming would have occurred. The reason for this is that, like brewing, the malting process depends upon a centralized location where the crop can be gathered and malted. Like many other forms of manufacturing industry during this time period, malting went through changes and advancements. The improvements that were made, such as mechanization of laborious tasks, gave the maltsters the ability to process more barley into malt. This is an example of how advancements in industry can create the ability to use more material and, in turn, create a larger market for that material.

Barley and malt manufacturing for the OBC took place over a very large portion of the United States during the entire time period that was studied. As early as 1899, 1900 and 1901 the barley for the malt used was grown in Wisconsin and California. What does change over the time period studied is that while staying mostly in the same regions malt production begins to take place at different sites. In 1910 malt is being produced in Rubicon as well as Jefferson County, Wisconsin. This is a reflection of both the growing demand for barley and malt from the OBC and many other breweries throughout the nation, as well as the great increase in the area of land being used to grow the crop.

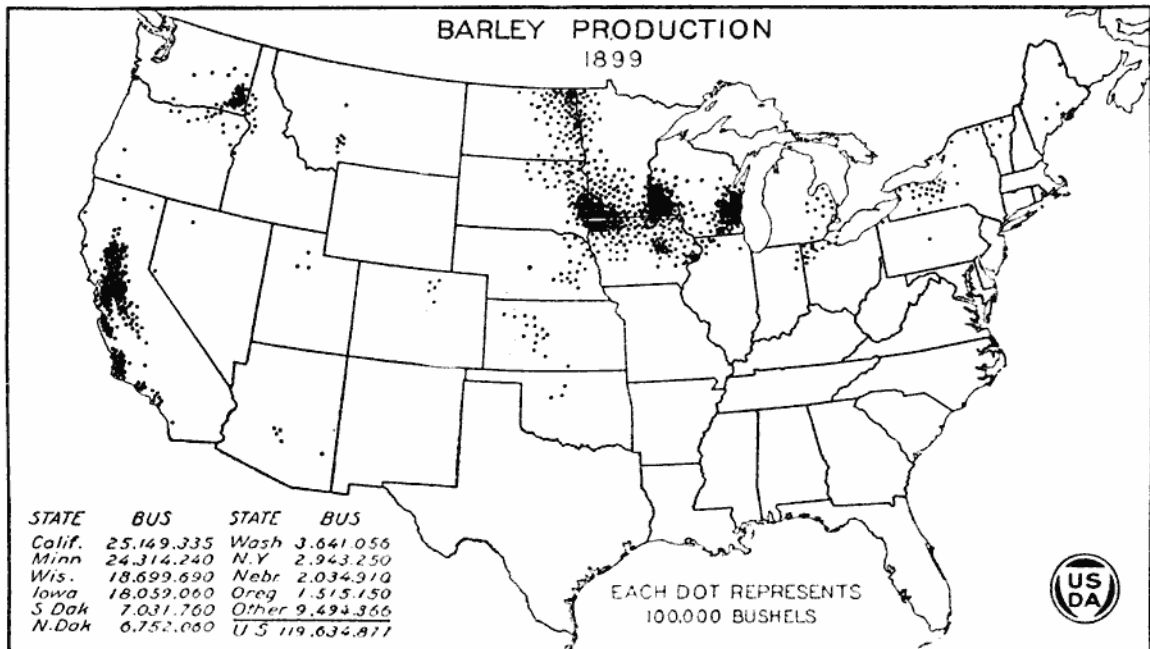


Figure 12. Map Showing Areas of Barley Production in 1899

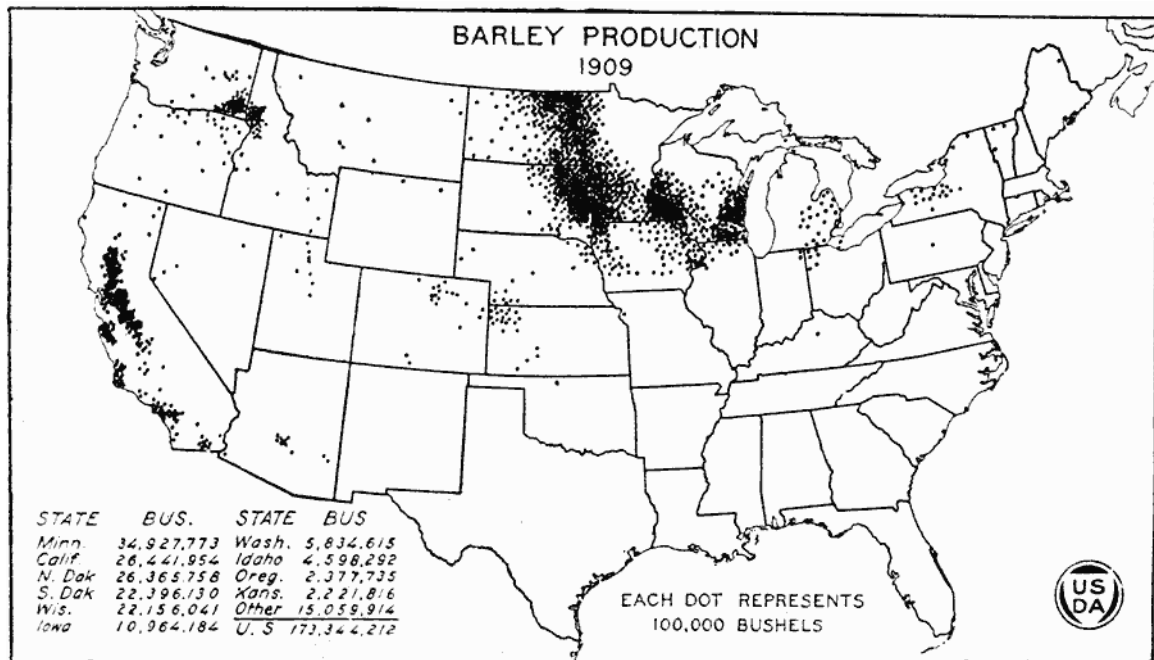


Figure 13. Map Showing Expansion of Barley Production in 1909

This explosion in the cultivation of barley created many more opportunities to purchase barley and malting operations also grew rapidly. Still, most of the barley used in brewing

came from the mid-west and southeast Wisconsin in particular. One of the most important factors in the places that produced the barley and malt for the brewery was the density of barley farming that took place in the region.

Even with these basic consistencies there were a few places of variation. One place where malt was purchased for a brief time was Manhattan, Montana, particularly in 1904. This was a venture by wealthy businessmen from New York to farm Gallatin Valley and produce high quality malt. While there was a significant market for the product, the land available to grow barley there was not as plentiful, and consequently most of the malt continued to be shipped from the Midwest. Other places where the malt that was used for brewing was purchased were Red Wing and Shakopee, Minnesota. These places became hubs for malt manufacture later in the study period as barley cultivation continued to expand westward into Minnesota, making Minneapolis and St. Paul, Minnesota, more competitive because of their access to an extensive rail network.

In addition to the expansion of the cultivation of barley as a factor in determining where the OBC malt originated, the availability of transportation to get the product to the brewery also played an important role. This proximity to rail transportation was one of the main factors that led to the consistency of the places from where malt was purchased. When the company was first getting started the supply lines that brought the raw materials to the brewery already existed and these same routes were likely used as long as the railroads were used. It is worth mentioning again that Leopold Schmidt was well traveled and successfully ran a brewery previously and would have been knowledgeable about the logistics of running the business.

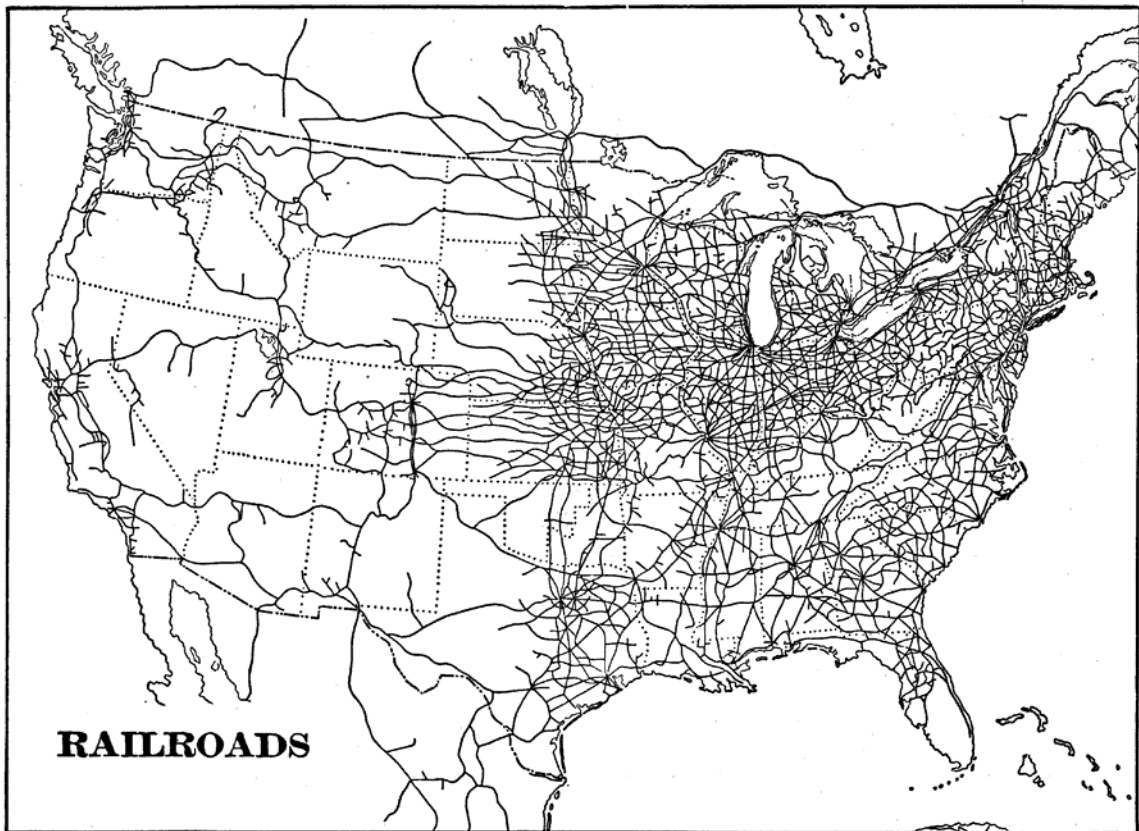


Figure 14. Railroads 1898

When transportation is considered, it is also evident that the places chosen to buy malt were advantageous from the beginning. While the railroad system grew significantly over the years, the major lines that were needed existed the entire time. The additional construction of spur lines were generally built in order to better accommodate product shipping.⁶⁰ In the case of barley consistency and security were gained by linking the source of the supply chain to an area where growing and production would only expand.

One of the most interesting observations that can be made about this analysis is that it tells a story of consistency in a time and place of dynamic change. The consistency in the beer produced by the OBC is a result of the careful attention given to the ingredients from which it was made. With few exceptions the barley that was used for brewing was grown within the same regions over the entire time period.

Hops and the Olympia Brewing Company

Hops production differed from barley because the places where the crops were grown followed the growth of brewing. During the years of 1900 and 1903, much of the company's hops were grown further away in areas where the yields were not as good. But during the years of 1907 and 1910 they were grown to a large extent in Washington State and were cultivated in areas close to the brewery. Those lower transportation costs and increased yields helped the company's bottom line and led to a more efficient use of resources. The hops that were grown in Bohemia were a special case and were likely

⁶⁰ Olympia Tumwater Foundation. Annual Report 1906, Olympia Brewing Company, Corporate Records, Reports, Annual Reports, Olympia Brewing Company 1900-1915 Box3

chosen for their well-known aromatic character. Having good land nearby that produced a lot of quality hops helped produce quality beer and helped reduce the land use impact.

Completing The Cycle

Barley and hops are crops that are of critical importance in brewing beer but it is important when attempting a life cycle analysis that the other ingredients and environmental impacts are also identified. In the case of the OBC rice and corn were used in conjunction with the malt to create a certain taste and lower cost. The water used would have also played an important role both for use in beer and powering the brewery. The transportation systems that supplied the raw materials and distributed the products needs to be better understood. Finally, the waste that was created could be quantified in some way. In an effort to understand the land use impact this study goes a long way, but in order to complete a more encompassing life cycle analysis more information would be needed.

Chapter 7: Conclusion

The goals of this research were to research the environmental history of the Olympia Brewing Company and to explore the ways in which Life Cycle Assessment could be used in environmental history research. Through the use of archival and historical research an avenue of exploration into the environmental history of the OBC was established. By examining the brew records, brew house logs, and annual reports the information was gathered to form a study of the land use that was needed to grow the barley and hops used to make beer in the early 20th century. This research forms the beginning of a full LCA of the early years of the OBC and provides proof of the concept for the practice of using the method in an environmental history.

Environmental history is at the core of this study and was present from its inception. Early in my research I did not find any evidence of environmental history that was done with a brewery as a subject. Also there was not significant research on environmental history that attempted to use a local industry in an attempt to flesh out its environmental reach far beyond the actual site of that industry. The Olympia Brewing Company is a fascinating subject that justifies as much research and understanding that can be discovered.

Life Cycle Assessment is a method that can be used by environmental historians examine the relationship between human development and the natural environment. One of the advantages of trying to use LCA in the research of environmental history is that it forces the historian to work within a certain framework that encompasses a big picture view of the subject. LCA also gives the historian a way of analyzing quantifiable data

that may present itself through the course of research. Using environmental history in conjunction with LCA brings together two very useful methods of understanding our place in this world.

Bibliography

- American Handy Book of the Brewing, Malting and Auxiliary Trades: A Book Of Ready Reference for Persons Connected with Brewing, Malting and Auxiliary Trades...Editors Robert Wahl, Max Henius Edition 2editors, 1901 The University of Wisconsin – Madison Jun 19, 2009 1266 pages
- Brewery Gems. Biography of Leopold F. Schmidt, Founder of Olympia Beer. Website <http://brewerygems.com/schmidt.htm> accessed February 8, 2015
- Comandaru, I. M., Bârjoveanu, G., Peiu, N., Ene, S., & Teodosiu, C. (2012). LIFE CYCLE ASSESSMENT OF WINE: FOCUS ON WATER USE IMPACT ASSESSMENT.
- Cordella, M., Tuganolil, A., Spadoni, G., Santarelli, F., & Zangrando, T. (2008). LCA of an Italian Lager Beer. *International Journal Of Life Cycle Assessment*, 13(2), 133-139.
- Cronon, W. (1991). *Nature's metropolis: Chicago and the Great West*. New York: W.W. Norton.
- Dresen, Boris, and Michael Jandewerth. "Integration Of Spatial Analyses Into LCA-Calculating GHG Emissions With Geoinformation Systems." *International Journal Of Life Cycle Assessment* 17.9 (2012): 10941103. *Environment Complete*. Web. 26 Feb. 2015.
- Dodge, John "Old Olympia Beer Brewhouse Remains Object of Fascination" *The Olympian*. November 24th 2013.
- Environmental analysis of beer production. (2005). *International Journal of Agricultural Resources, Governance & Ecology*, 4(2), N.PAG.
- Fava, J., Baer, S., & Cooper, J. (2009). Increasing Demands for Life Cycle Assessments in North America. *Journal Of Industrial Ecology*, 13(4), 491,494.
- Guinée, J. B., Heijungs, R., Huppes, G., Zamagni, A., Masoni, P., Buonamici, R., & Rydberg, T. (2011). Life cycle assessment: past, present, and future. *Environmental Science & Technology*, 45(1), 90 96.
- Hospido , Almudena. Moreira, Theresa. Feigoo, Gumersindo. *Environmental analysis of beer Production*, *International Journal of Agricultural*

Resources. *Governance and Ecology*, Vol 4, No.2 2005.

Hoverson, Doug. *Land of Amber Waters the History of Brewing in Minnesota*. Minneapolis: U of Minnesota, 2007. Print.

Hughes, J. Donald. "Three Dimensions Of Environmental History." *Environment & History* (09673407) 14.3 (2008): 319-330. *Environment Complete*. Web. 19 Jan. 2015.

International Brewers' Journal, Volume 44. W. Reed. 1908 the University of California, Digitized Apr 24, 2013 Koroneos, C., Roumbas, G., Gabari, Z., Papagiannidou, E., & Moussiopoulos, N. (2005). Life cycle assessment of beer production in Greece. *Journal Of Cleaner Production*, 13(4), 433-439. doi:10.1016/j.jclepro.2003.09.010

Loiseau, Eléonore, et al. "Adapting The LCA Framework To Environmental Assessment In Land Planning." *International Journal Of Life Cycle Assessment* 18.8 (2013): 1533-1548. *Environment Complete*. Web. 26 Feb. 2015.

Mattila, T., Helin, T., & Antikainen, R. (2012). Land use indicators in life Cycle assessment. *International Journal Of Life Cycle Assessment*, 17(3), 277286.

Mattila, T., Lehtoranta, S., Sokka, L., Melanen, M., & Nissinen, A. (2012). Methodological Aspects of Applying Life Cycle Assessment to Industrial Symbioses. *Journal Of Industrial Ecology*, 16(1), 51-60.

Mattila, T., Leskinen, P., Soimakallio, S., & Sironen, S. (2012). Uncertainty in environmentally conscious decision making: beer or wine?. *International Journal Of Life Cycle Assessment*, 17(6), 696-705.

McCarthy, Mary. *On the Contrary*. New York: Farrar, Straus, and Cudahy, 1961. Print. Mittelman, A. (2008). *Brewing battles a history of American beer*. New York: Algora Pub.

Nash, Linda. "Furthering The Environmental Turn." *Journal Of American History* 100.1 (2013): 131-135

Norris, G. A., Della Croce, F., & Jolliet, O. (2002). Energy Burdens of Conventional Wholesale and Retail Portions of Product Life Cycles. *Journal Of Industrial Ecology*, 6(2), 59-69.

Ogle, M. (2006). *Ambitious brew: The story of American beer*. Orlando:

Harcourt.

Olympia Brewing Company Archives, Olympia Tumwater Foundation.
Tumwater WA

Oosthoek, K.J.W. (2005), *What is Environmental History?*, www.eh-resources.org/environmental_history.html. Accessed: 14 February 2008.

Opie John. "Environmental History: Pitfalls and Opportunities,"
Environmental Review 7 (1983): 8-16,

Pattara, C., Raggi, A., & Cichelli, A. (2012). Life Cycle Assessment and Carbon Footprint in the Wine Supply-Chain. *Environmental Management*, 49(6), 1247-1258.

The Railway Age, Volume 31 Published 1901,Original from the New York Public Library. Digitized Jan 8, 2010

Satran, Joe "Craft Beer Growth Pushes Number of Breweries in U.S. Higher Than Ever Before" The Huffington Post 12/13/2012.

Stack, Martin. "A Concise History of America's Brewing Industry". EH.Net Encyclopedia, edited by Robert Whaples. July 4, 2003.
URL <http://eh.net/encyclopedia/a-concise-history-of-americas-brewing->

Stevenson, Shanna. Olympia, Tumwater, and Lacey : a pictorial history.
Virginia Beach, VA : Donning Co. 1996

Sutter, Paul S. "The World With Us: The State Of American Environmental History." *Journal Of American History* 100.1 (2013): 94-119.

SZABÓ, PÉTER, and RADIM HÉDL. "Advancing The Integration Of History And Ecology For Conservation." *Conservation Biology* 25.4 (2011): 680-687.

Taylor, Bron. "'It's Not All About Us': Reflections On The State Of American Environmental History." *Journal Of American History* 100.1 (2013): 140-144

Traffic World, Volume 9.Traffic Service Corporation Traffic Service Corporation, 1912 University of Minnesota Aug 18, 2014

United States Brewers Foundation, Proceedings of the Annual Convention, Volumes 45-47, United States Brewers' Association 1907.

United States Environmental Protection Agency, Life Cycle Assessment (LCA) <http://www.epa.gov/nrmrl/std/lca/lca.html#define> Accessed Feb 2nd 2015.

United States. Dept. of Agriculture. Bureau of Statistics. Crop Reporter ..., Volumes 8-10 U.S. Government Printing Office, 1906. University of Chicago, Digitized Jun 17, 2011

U.S. Department of Agriculture, National Agricultural Library, Yearbook of the United States Department of Agriculture 1906. Volume 1907 U.S. G.P.O

U.S. Department of Agriculture, National Agricultural Library, Yearbook of the United States Department of Agriculture 1910. Volume 1911 U.S. G.P.O

United States Environmental Protection Agency (“Life-Cycle Assessment | Sustainability Analytics | Research | US EPA”) 2006

White, Richard. *The Organic Machine*. New York: Hill and Wang, 1996. Print.